SCIENTIFIC AMERICAN

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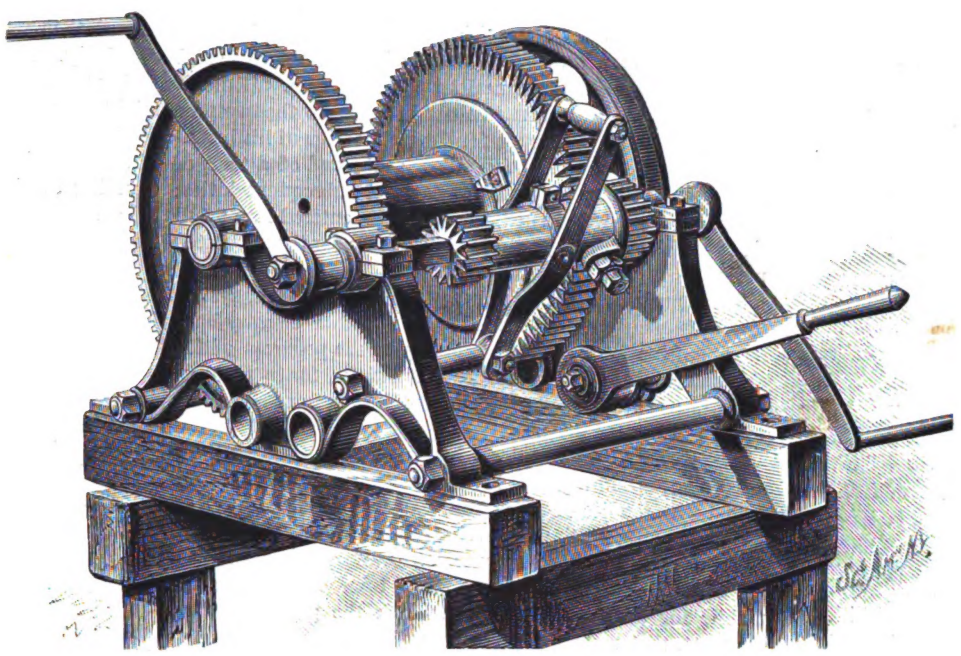
IMPROVED HOISTING MACHINERY.

In the annexed engravings are represented a new hand outrigger or hatchway hoist, and a crane or derrick hoist, for which several valuable advantages are claimed. The derrick hoist, Fig. 1, is provided with shifting gears on the crank shaft, arranged to be operated by a hand lever so as to be thrown into or out of contact as desired, thus enabling the brake wheel on the drum shaft to be more easily overhauled. The entering sides of all the gears are V shaped. The sliding shell is also provided with a spring pin to retain it in either position by springing into V indents in the shaft on which it slides.

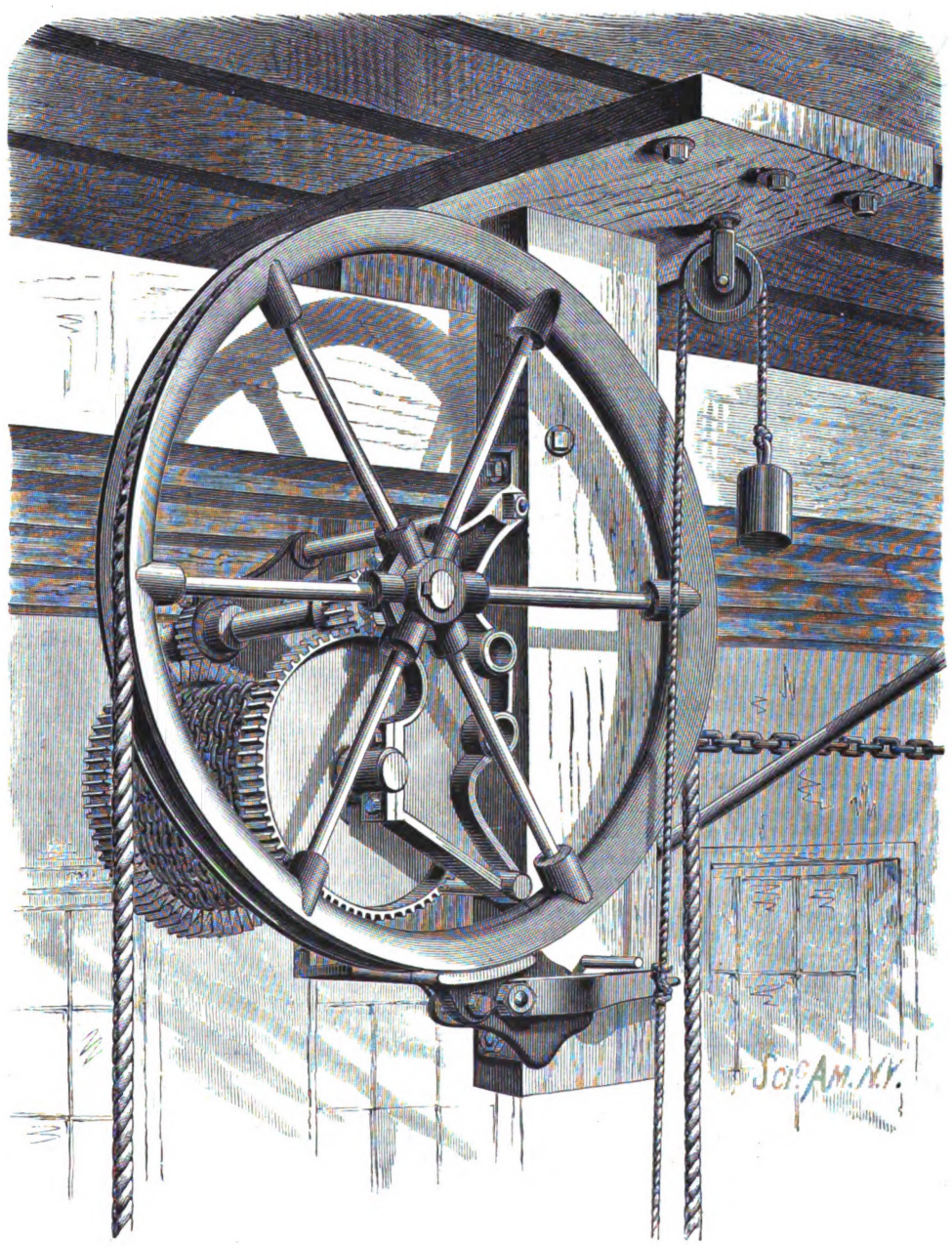
The mode of using two gears, one on either end of the drum, is new, as well as the method of sliding the gears on the square shaft to connect on either side for the purpose of getting two powers or capacities of hoisting, as well as to throw both gears out of connection for rapidity in lowering.

In the outrigger hoist, Fig. 2, the advantages are that two pinion gears are employed, gearing into two large gears. As both the larger gears are bolted to the ends of the drum flanges, this relieves the shaft of all strain, as is the case usually when the large gears are applied outside and the drum inside the bearings. The use of two gears instead of one (as is usually the case) evens the strain on both ends of the drum, while if one gear should get broken the machine will not be disabled. The brake is applied very simply by a lever and shoe on the circumference of a groove in the rope wheel. It is entirely clear of the wheel when the pull on the check rope is released by means of the weight overhead. The machine, being all complete in a single iron frame, is easily erected, and its bearings are not liable to get out of line.

For further particulars address the manufacturers, Messrs. Volney W. Mason & Co., Providence, R. I.



MASON'S DERRICK HOIST.



MASON'S OUTRIGGER HOIST.

A British Man-of-War Capsizes.

One more disaster, this time attended with terrible loss of life, is to be added to the long list of casualties which, during the last few years, have overtaken the British navy. The training ship Eurydice, a wooden vessel of 921 tons, was, on March 24, struck by a squall off the Isle of Wight, and almost immediately capsized and sank, carrying down with her some 400 sailors. Nothing but the grossest carelessness and bad seamanship can account for a disaster of this kind. A similar fate occurred to the ironclad Captain, it will be remembered, some years ago; but that was directly attributable to her low free-board and otherwise faulty construction, and her designer paid for his errors by being lost with her. For a wooden sailing vessel thus to be wrecked is phenomenal, but it is no more discreditable than the ramming of the Vanguard by the Iron Duke, or sundry other events which lead to the conviction that British war vessels stand more in need of protection against the men who handle them than against the enemies they are to confront.

Iron Hail.

While examining, by the microscope, the pulverulent matter in the air, in the sediment obtained from Alpine snow, and in rain water, MM. Tissandier and Meunier recently detected among the objects attracted by a magnet numerous spherules remarkable for the geometric regularity of their form. These were found to be identical with the similar spherules produced by burning metallic iron in air, and hence it was conjectured that whenever meteoric iron enters our atmosphere large numbers of these minute bodies are produced. This view is confirmed by microscopic examination of the crust of the meteorites, on which rounded grains resembling the sedimentary spherules are quite apparent. Moreover, analysis has shown that the spherules contain nickel, which still further points to their meteoric origin. Not only have these metallic globules been detected in the air and water of widely separated places, but they are brought up by dredges from the sea bottom, and are found in geological strata dating far anterior to the presence of man on earth. It would appear, then, that from some early geological period a rain of iron globules has been going continuously on. It would be of great scientific interest to determine, if possible, when this iron hail began, and to what extent it has augmented the iron supply of the earth.

New Mode of Warming Railway Cars.

An experiment was lately made by the New York Elevated Railroad Company in the use of a newly invented apparatus for heating a train of cars by the surplus steam from a locomotive, and satisfactory results were obtained.

The apparatus consists of a chain of pipes extending through the cars on each side, connected between the cars and the locomotive by an elastic hose, wound to prevent condensation, and with couplings similar to those used for the car brakes. The dome, or some convenient steam main on the locomotive, is tapped for a small pipe, in which is a valve, by which the engineer or fireman can control the heat in the cars. Under the car body are two expansion valves to allow vent for the air when steam is first turned on, and also to allow the cold water of condensation to be freed from the pipes and to prevent freezing. The pipes inside the cars are inclosed within other and thinner pipes, and the space between the two is packed with fine dried sand.

The heat from the hot steam pipes is imparted to the sand, which radiates it through the thin outer pipe. By this means the heat of 350° which is imparted to the inner pipe is given off so gradually as to keep the cars comfortably heated for two or three hours. So that by charging the apparatus before the train starts, and from time to time throwing into it the surplus steam which would otherwise have to be blown off and wasted, the necessity for stoves is obviated, as well as the danger of fire in case of accident. It is also claimed that the proper ventilation of the cars is rendered easier by this process than by the use of stoves.

Sound Colors.

At a recent meeting of the Physical Society, London, Mr. Sedley Taylor exhibited the colors produced in thin films by sonorous vibrations. A piece of thin brass, perforated with a triangular, circular, or rectangular aperture, and bearing a thin film of soap solution, was placed horizontally on one end of an L shaped tube; the beam of the electric lamp, after reflection from it, was received on a screen. It was shown that, when a sound is emitted in the neighborhood of the open end of the tube, the film takes up a regular form, which is indicated by the different colors of the reflected light, and each note has its own particular color figure; and, further, with different instruments we have different figures. Thus, when a square film was employed, a kind of colored grating was the result, which was modified by changing the note, and with a circular film concentric rings, traversed by two bars at right angles, were observed.

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THE PROPOSED EMASCULATION OF THE PATENT LAW.

Section II. of Mr. Wadleigh's amended patent bill, now before the Senate, reads as follows:

"On each and every patent for an invention issued after the passage of this act, there shall be paid to the Commissioner a duty, as follows, namely: Fifty dollars to be paid on or before the first day of January occurring next after the expiration of four years from the date of the original patent, and one hundred dollars on or before the first day of January occurring next after the expiration of nine years from the date of the original patent; and in default of any such payment, the patent shall expire on the first day of April next thereafter. But the Commissioner, for good cause shown, may allow the payment to be made at any time before such first day of April, in which case the patent shall not become void. The Commissioner shall annually, in the month of April, publish a list of the patents which have expired for non-payment of duties." (The remainder of the section provides simply for the recording and certification of the prescribed payments.)

It is much to be regretted that a bill, otherwise commendable, should embrace a provision like this, since it involves nothing less than an abandonment of a characteristic and valuable feature of the American patent system. Hitherto this country has stood almost alone in giving to the inventor an absolute patent in return for the publication of his invention, and its surrender to the public at the end of a term of years. There have been no drawbacks or subsequent duties; once the patent was issued, the patentee entered into a full and exclusive right to control his invention for the stipulated period.

The beneficial effect of this feature of our patent system has been amply demonstrated. In no other country have *poor* men contributed so enormously to the progress of the arts and sciences through useful inventions, for in no other country have the benefits of patent rights been so accessible to men of limited means.

The theory of the founders of the system was substantially this: The life of a patent is but an insignificant period compared with the life of the nation. Even should the patentee be unable or unwilling to develop his patent, the publication of his idea and its surrender to the community at the close of a limited term of years more than compensate the public for the special privilege which the patent confers. At most, that merely deprives some other possible inventor of the *same* device, during the life of the patent, of the privilege of controlling *his* invention; and the injury likely to be done through such infrequent occurrences is as nothing compared with the good sure to flow from the issue of unrestricted patents. Accordingly no conditions were affixed to the right. The inventor was not compelled to put his device into practical use within a specified time on pain of forfeiture of his right, as in other countries.

He was not compelled to issue licenses to make or use his invention. He was not required to keep his patent alive by periodical fees. In short, his right, so long as it lasted, was absolute and unconditional. And the working of the system has abundantly demonstrated the wisdom of its founders.

It is now proposed to reverse this principle. In obedience to the wishes of wealthy corporations, which would naturally like to control all patents issued for inventions within their spheres of operation, it is proposed to discriminate against inventors of limited means. Worse, it is proposed to reduce the actual life of patents from seventeen years to four years, with the privilege of extending that life to the full period on the payment first of fifty dollars, and subsequently one hundred dollars more.

Since the existing patent fees more than suffice to support the Patent Office, the proposed increase of cost cannot be justified on the score of necessity. Its sole purpose is to facilitate the confiscation of valuable patents by those who want to use them without payment therefor; and we are confident that the obnoxious section will be stricken out before the passage of the act, provided the attention of the Senate is called to its vicious effect.

Inventors do not spend their time and strength and means in putting their ideas into material form, and thus communicating them to the world, from a pure love for invention. They work like other men for pay. There is no public fund provided for the hiring or rewarding of inventors, nor is it desirable that there should be such a fund. It is desirable, however, that invention should be encouraged; and the simplest and best way to do this has been found to be through the granting of patents; that is, simple official recognition of a limited property right in the fruit of one's thought and labor.

The life of a patent is now seventeen years. Should the new bill be passed as it stands, the assured life of patents will be reduced to four years—certainly an unjustifiable lessening of the encouragement hitherto held out to inventors.

But, the friends of this Section II. may urge, four years is time enough to show whether a patent is worth anything, and fifty dollars is no great sum to pay for the perfecting of an inventor's title for five years more. If the inventor does not think it worth fifty dollars, it had better be killed and out of the way.

There are several fallacies and false assumptions here. There have been multitudes of valuable patents whose real worth has not been demonstrated during the first four years; often the inventor's reward does not fall to him until nearly the end of the allotted seventeen years Very often the additional fees proposed would bear so heavily upon the inventor as to cause him to relinquish his apparently barren, yet really valuable, right; and there is just where this feature of Mr. Wadleigh's bill may be made the means of working grave injustice to deserving inventors, in addition to its general bad effect in discouraging invention. If any change at this point is to be made in the working of the system, it should rather be toward diminishing the fees, and thereby increasing the inducement held out to poor men to develop their inventive genius. There is no telling how many suggestions of infinite possibilities for the public good may already have been allowed to die undeveloped, for the simple reason that their immediate promise has not seemed to warrant the sacrifices involved in taking out a patent. Small as the charges of the Patent Office are, compared with those of other countries they are still of serious magnitude to poor men.

But the worst phase of this obnoxious section is seen through the door it opens for the subjection of many inventors to the mercy of grasping corporations, whose inordinate selfishness needs no such encouragement. The manifest anxiety of such parties to have certain patents killed and out of their way is conclusive evidence of their value to somebody. And it is quite possible that the prospect of enjoying the free use of an invention at the end of four years might often induce covetous corporations to unite in its condemnation, thereby depriving the public of the benefit of the invention during that period, as well as ultimately defrauding the inventor, who might be unable to perfect his title or unwilling to sink more money in a right that promised no return.

No doubt it is often unpleasant, both to individuals and corporations, to pay an inventor his price for the use of his invention; but that does not justify their robbing him. Much less would it justify the public, which has been so enormously benefited by the law as it stands, in emasculating the system to facilitate the robbery.

"KERAMICS" AND WOMAN'S WORK.

The desire to decorate pottery for purposes of household adornment seems to be a kind of chronic inclination which suddenly affects large numbers of people at the same time, and as suddenly disaffects them. The influx of paste, paint, and varnish pots, of jars and vases of glass and crockery, of sheets of gayly colored pictures, into that part of the domicile sacred to the feminine members of the family usually indicates the beginning of the attack; the prevalence of said jars and vases (which too often are liquid blacking bottles or ginger pots artfully disguised) in the parlors marks its advanced stage; and the contemptuous removal of the same to the attic, under the stigma of "looking cheap," denotes its termination. Thus far the mania has appeared in three forms. About fifteen years ago it bore the name of *potichomanie*, and it took the form of pasting scrap pictures inside of clear glass jars, backing them with thick white paint, and then persuading yourself that an accurate counterfeit of Oriental porcelain had been produced. This gave place to *decalcomanie*, a useful species of decoration which enables colored pictures printed on gelatine films to be applied to any smooth surface. It is much in vogue yet for decorating cheap furniture, carriages, and safes; but during its fashionable prevalence no object of household use was safe from its incursions, and the marble center table or the kitchen pails were beautified with indiscriminating impartiality. The term *keramics* has lately been twisted out of its proper signification to be popularly applied to the sticking of paper pictures on pottery of any kind, and adding a coat of varnish, an alleged imitation of painted china being the result.

Upon the broad general principle that anything which tends to increase the popular taste for beauty is to be encouraged, the above named manias may be beneficial apart from their obvious utility as a means of amusement; but, on the other hand, when it is remembered that the same inclinations, directed in the proper channel, may with little or no more labor produce objects of real artistic merit and of far more value as educating and refining the tastes, it would almost seem that time and talents are being wasted. Nothing that is false is artistic. Decorated ginger pots are in truth but ginger pots; blacking bottles cannot be foisted upon the world as Etruscan vases or Haviland faïence. A certain amount of falsity is conventionally accepted, such as imitation wood and sheet iron architectural ornament; but when an object is diverted from its recognized use, especially if that use be humble, the deception is only tolerated for a time, and eventually is repudiated; and the pity of it is that so large an amount of the female energy in the world seeking an outlet finds it in such a way. The legitimate result is the degradation of woman's work as a unit in social economy, for while no one would wish to do away with the numberless delicate devices which the feminine mind delights in conceiving, or would remove one source of pleasure to the gentler sex, all must agree that if that work were, as a rule, directed to the production of objects, no matter how intrinsically trivial, which satisfied the precepts of correct artistic taste, and were capable of affording permanent gratification, there would be less heard about the lack of openings for woman's labor.

It requires but a brief glance at the statistics of our imports and exports to show how largely dependent we are upon foreign nations for objects valuable only because beautiful. Take the class known as fancy goods: for the year ending last June we exported these to the value of $335,310, and imported them to the value of $3,828,302. We imported nearly four million dollars' worth of china and stone ware,

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which includes nearly all the decorative pottery used in the country. It is true that manufacturers in this vicinity are making great efforts to produce as finely decorated porcelain as can be obtained from abroad. and their progress has been satisfactorily rapid; but it needed only a casual examination of the exceptionally fine display of American porcelain at the American Institute Fair of last year to show that artistic taste and skill were even more lacking than the ability of the manufacturer to reproduce the delicate or rich colors of the foreign ware. There can be no question but that we have in this country every variety of clay necessary for the production of all kinds of pottery from earthen ware to porcelain. Indiana kaolin is claimed to be superior in composition and perfect whiteness to any European clay. We are producing large quantities of common ware, which, although it requires skilled labor, does not enlist the artistic element. We would produce fine ware if the artistic ability which abundantly exists in the country could be properly brought into play.

But, as we have endeavored to point out above, a large percentage of that ability among the women who, by their inherent delicacy, natural refinement of taste, and physical circumstances are far better suited to its exercise in ceramic art industry than are men, is being frittered away aimlessly and uselessly. Perhaps worse than this, for they are filling their homes with objects which falsely educate the eye and mind, and lead the rising generation to form its first standard of taste upon vicious principles. At the same time they are neglecting the cultivation of a field which urgently needs laborers. Women who are competent to decorate pottery finely will find their services in ample demand, and their means of livelihood secure against chances of fortune. Whether the art be followed for this reason or as an amusement only, it is refining and educating, and its influence is always beneficial, and this cannot be said of "potichomanie," "decalcomanie," or "keramics."

THE MANUFACTURE OF DAUBS.

Art degraded to a trade, the *Tribune* calls it, but that is an insult to honest industry. It is because the daubs are made to be sold for what they are not that the business of making and mounting imitation works of art is objectionable. The daubs, known to the trade as "buckeyes," are turned out by the thousand, some shops in this city being able to produce them at the rate of a hundred a day. About nine tenths of them are copies of landscapes. The "artists" need only so much skill as will enable them to handle a common paint brush or to manage a stencil plate. In many of the shops the most of the work is done by boys and girls earning from fifty cents to a dollar a day. The maturer workmen paint by the piece, getting from fifty cents to two dollars for each painting.

They paint entirely by rule, using paints and canvas prepared by the manufacturers. The canvas costs about eight cents a square yard. Poor artists are employed by the day to touch up the pictures, which are varnished to hide their more glaring faults, and then flashingly mounted in imitation gilt frames. The entire cost of paintings and frames is about one fifth the cost of good frames; yet when new they appear very attractive to the inexperienced, especially when displayed under gas light in auction rooms. Placarded as choice collections of American and foreign artists, daubs, which can be bought of the manufacturers at the rate of $50 a dozen, often sell for $20 or $30 a piece.

The largest manufactory of such paintings in the city occupies the whole of a three story building. The most of the pictures go out of the city. The owner said to the *Tribune* reporter: "I get orders from all parts of the country now, and can fill an order for a hundred pictures with a few hours' notice." The prices of this maker range from $80 to $100 a dozen, frames included, most of these pictures being 36x22 inches, a size convenient for the economical cutting of canvas. At a rival shop the prices ranged from $40 to $150 a dozen. Another manufacturer of "buckeyes" of a smaller size sells them for $16 a dozen.

The swindling devices adopted by dealers in these fraudulent pictures are those of mock auctioneers everywhere; and the manufacturers abet the swindle by signing their daubs with the names of popular painters ingeniously misspelled, or with initials wanting. It is a common trick of hawkers of these pictures to profess to be artists in distress and willing to leave valuable pictures as security for a small loan; or they are about to leave the city to fulfill a profitable engagement, and would be glad to sell at a great sacrifice to raise the money needed for the journey. A gentleman who took a painting as security for a loan of $80, the other day, discovered soon after that the regular price of the picture "by the dozen" was fifty cents a piece!

THE SCIENTIFIC APPLICATIONS OF PHOTOGRAPHY.

In a recent article we briefly reviewed late progress in astronomical photography. In the present we propose to point out some of the latest and most curious applications of photography to scientific investigation, besides its special adaptations to many useful purposes, many of which have been recently explained by M. Radau.

With the magnificent panoramic views of sketches of landscape which it is now possible to produce by photography every one is familiar. Apart from the value of these as works of art, they have practical applications to topographical uses, to which reference will be made further on. A curious feature of photographic representations of archæological objects is that the careful study of the picture is often the means of revealing facts hitherto unnoticed. For example, on a photograph of the Acropolis, at Athens, Baron Gros discovered, by the aid of a lens, a curious carving on one of the stones which formed part of the ruin. The engraving represented a lion devouring a serpent, the design evidently dating from an ancient Egyptian epoch. Another odd circumstance is that photography sometimes reveals things totally invisible to the eye. Inscriptions on ancient manuscripts have thus been brought to light. The ink, containing peroxide of iron, had faded so that it was no longer visible, but it had affected the photogenic power of the surface, so that in the photographic print the characters once more appeared in their original blackness.

Geodesy and military topography now find an important aid in photographic views. The picture being produced by lenses is made to conform to geometrical rules, and represents a central perspective much more exactly than could be produced by means of measuring instruments. A number of such photographs of a given locality, taken from different stations, allow of the determination of both the relative situation and the location of objects, and thus charts may be accurately constructed without the necessity of making actual surveys.

It has been proposed in this way to map new regions, such as the interior of Africa, photographs being taken of large expanses of country from commanding eminences, thus avoiding a large amount of arduous personal labor. Military maps are not only now reproduced in large numbers by photography, but they are supplemented by numerous views of the district plotted, so that an army in strange territory is thus afforded minute information, not only of the general physical characteristics of the region, but of its minute peculiarities.

There is probably no more important application of photography to scientific uses than as an auxiliary to meteorological work. Photographic registering apparatus operating automatically produces curves, which show by simple inspection all the phenomena incident to climate. If, for example, it is necessary to register the indications of a barometer or thermometer, a clockwork movement unwinds in rear of the instrument, which is suitably illuminated, a band of sensitized paper, on which the varying heights of the mercury are recorded.

Atmospheric pressure is registered in this way by the aid of an ordinary barometer, suspended so that the shadow of the mercury meniscus and the divisions of a scale traced on the tube are projected simultaneously on the sensitized leaf. To record the movements of a thermometer the beam of light is caused to pass, not through the vacant space above the mercury, but through a small air bubble introduced in the mercurial column, and which thus serves as an index. The addition of a wet bulb thermometer allows of the production of two thermometric curves, which separate as the air becomes drier, or approach when more moisture is present. The relative humidity of the atmosphere may also be registered by means of a hair hygrometer, the needle of which travels across the slit through which the beam of light passes.

In order to record the fluctuations of terrestrial magnetism, movable magnetized bars are used, each having attached to it a small mirror which, when at rest, forms the prolongation of a fixed mirror. The beams of light which the two mirrors reflect through a slit describe on the sensitized paper a black spot, which becomes a line as the paper moves. The least oscillation of the bars causes the separation from this line of the trace produced by the movable mirror, and in this way all the movements of the magnetized bar are registered. It will easily be understood how arrangements analogous to the above will allow of an exact representation of all the physical or physiological phenomena which are manifested by visible movements. M. Stein, for example, proposes thus to record the level of tides, now commonly marked by a pencil fixed to a vertical rod attached to a float. M. Neumeyer, of Berlin, has constructed an ingenious apparatus for studying submarine currents and determining the temperature of the sea bottom. A copper cylindrical box, which is attached to the sounding line, contains a thermometer and a magnetic needle, which are illuminated by Geissler tubes filled with rarefied nitrogen, through which electric sparks are passed. This light suffices to mark in less than three minutes, on sensitized paper, the image of a mercury column and the position of the magnetized needle. A sort of vane or rudder attached to the box serves to maintain the "lubber's point" of the compass in the direction of the current.

Dr. Forel has adopted the same means of investigation to the examination of the causes which produce periodical variations in the transparency of the water of Lake Leman. This water is more transparent in winter than in summer, and in order to determine the extent of this variation, it became necessary to obtain precise numerical data. One method used consisted in placing at the bottom of the lake a box, in which was adjusted under glass a sheet of sensitized paper. This was left for two days exposed to the solar rays which passed through the water. Half of the paper was covered by a screen, so that the degree of coloration could be determined by comparison. On removing the sheet the color was fixed by hypo solution, and it was then compared with a scale of shades determined in advance. In this way it was found, for example, that in February, at the depth of 160 feet, a coloration represented by 20 was obtained, while during July no effect was visible at the same depth. The limit of obscurity was thus found to be 160 feet in summer and 820 feet in winter. This was verified by noting the depth at which a white disk attached to a sounding line ceased to be visible. M. Forel reached the conclusion that the cause of the variation in the transparence was the presence of organic matters in the water, which distributed themselves differently in summer and winter.

The study of the solar spectrum and other luminous spectra has been greatly advanced by the intervention of photography, which has been the means of recognizing dark lines or spaces in the ultra violet region. the rays of which produce scarcely any impression on the retina. A large number of such lines have been thus determined by Rutherford, Draper, and Mascart. Similarly Vogel has made some new discoveries with regard to the obscure rays in the red region. He has found that it is sufficient to mix with collodion coloring matters which absorb the red rays to render it sensitive to the action of such rays, so that the special designation of "chemical rays" applied to those of the violet and ultra violet region may be considered as obsolete, all the spectral colors being capable of affecting a photographic plate properly prepared.

Photography renders important aid in physical investigations. Bunsen and Roscoe, by the aid of sensitized paper, have measured the changing intensity of solar radiations. Dr. Stein has photographed zigzag lightning. The indented image of the manometric gas flame produced on the rotating mirror has been photographed. Instead of ordinary illuminating gas cyanogen is now employed, on account of the superior photogenic power of the flame. The rapid oscillations of tense cords and the beatings of the human pulse have also been photographed. The applications of photography to medical studies are numerous and valuable. Without mentioning the faithful reproduction of anatomical preparations, which is facilitated by the injection of colored liquids, it is possible to send the investigating ray into the depths of the living body. To the ophthalmoscope, which reveals the inner eye, the laryngoscope, which shows the interior of the throat, the otoscope, which explores the ear, may be added the sensitized plate on which the image of the impaired organs may be fixed. By the aid of photomicrography, images of microscopic objects, the rapid alteration in which fatigues and baffles the eye, may be permanently caught. Dr. Duchenne, of Boulogne, has made a complete series of photographs of muscles under the influence of various passions (the electric current being used to produce the necessary contractions), which have been of great assistance to Mr. Darwin in his study of the expression of emotions in man and brutes.

Perhaps most curious of all the applications of photography is its possible adaptation to the discovery of disease. Vogel mentions a case where the face of a sitter appeared in the portrait covered with spots, although none were visible on the skin. On the day following that on which the picture was taken, an eruption did appear, and the person afterwards died of varioloid. The feeble yellow of the incipient pustules had evidently affected the sensitized surface, and the disease had shown itself to the camera before it had been recognized by the doctors. Lastly, we may mention Dr. Ordtmann's suggestion of the value of collections of family photographs in the study of anthropology. He has already begun the collection of large numbers of portraits, and from these he proposes to investigate what modifications selection may exercise on the hereditary transmission of personal characteristics.

Torpedo Inventions Wanted Abroad.

Inventors will do well to remember that now is the time to bring out military inventions, and especially devices relating to torpedoes and torpedo defense. The Russo-Turkish war afforded very little opportunity for the testing of the efficacy of torpedoes in actual combat, though the blocking of the Russian harbors on the Black Sea by their agency against the Turkish fleet added some new proof of their value as a means of keeping off an enemy. The difficulty between Russia and England is, however, so far from adjustment that both powers are busily arming. Recent intelligence reports the Russians as building 100 new torpedo boats, and that the English are giving out large contracts for the same kind of craft and for immense numbers of torpedo sinkers. Inventors who have ideas on the subject should now get them into practical form, and after obtaining the necessary protection take steps to lay them before the English or Russian authorities. The English government receives and examines inventions of this kind, on their being submitted to the Admiralty.

WORK is being pushed upon the Gilbert Elevated Railroad, in this city, with great vigor, and the cars are to run next month. The iron work is covered with a soft drab color quite agreeable to the eye, and in good contrast to the dark somber colors often used upon iron bridges, etc. The contract for supplying paints for the Gilbert road has been awarded to the H. W. Johns Manufacturing Company, and is said to be the largest contract ever made for any single structure in this country.

MANY alloys of tin and other metals, which are rendered harder by additions of antimony, copper, etc., do not, when struck, emit a clear sound. M. Lilliman, says *Les Mondes*, finds that this may be remedied by dipping the metal for about a minute in a bath of paraffin or oil heated to a temperature of 122° Fah. This operation is said to augment the hardness of the alloy.

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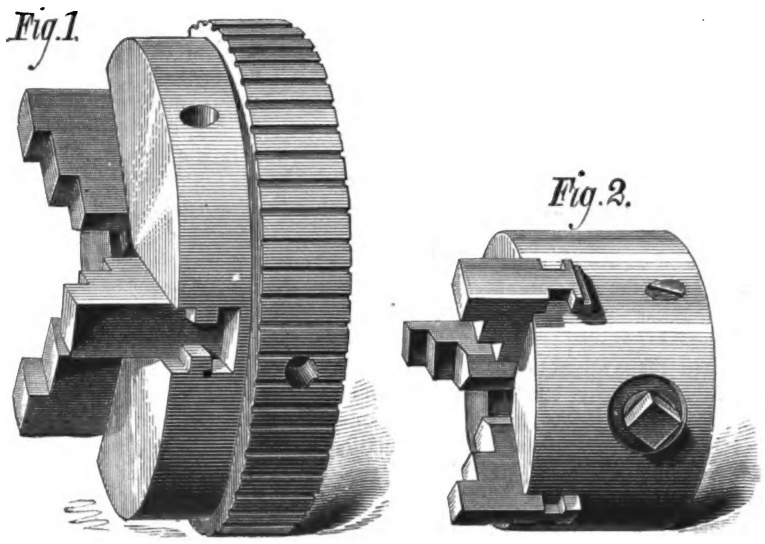
IMPROVED LATHE CHUCKS.

We illustrate herewith two improved lathe chucks of simple design, and constructed of strong and durable material. The chuck represented in Fig. 1 is made essentially similar to the new centering device which we illustrated last week. That is, the jaws move radially in one portion of the device, while recesses on their under sides engage with a scroll on the face of another and rear portion, so that when the latter is turned by a lever the jaws are caused to move toward or from the center. The jaws are of wrought iron or hardened steel, depending upon the size of the chuck, and the scroll is of forged wrought iron. Fig. 2 is an improved geared scroll chuck, in which the scroll is rotated by a pinion which engages with a gear on the rear face of the scroll plate.

The end of the pinion shaft is squared and protrudes, as shown, so as to be turned by a key. The pinion is of forged steel, the jaws of steel, and the remainder of wrought iron.

The workmanship of these chucks is accurate and good, their material of the best, and their price moderate. They are in all respects excellent and efficient devices, and may be commended to machinists generally. For further particulars address the manufacturer, Mr. A F. Cushman, Hartford, Conn.



CUSHMAN'S IMPROVED CHUCKS.

Snake Cannibalism.

A contributor to the SCIENTIFIC AMERICAN, in an article which appeared in the issue of March 16, 1878, descriptive of the habits of snakes, expressed the opinion that there were no *ophiophagi*, or snake-eating snakes, in this country.

We have received several communications in which the writers cite incidents coming under their observation, which seem to prove the contrary.

One correspondent, H., of Poughkeepsie, N. Y., writes: "While rambling through the woods near Dedham, Mass., one afternoon, some years ago, I suddenly came upon a large black snake in the act of swallowing a garter snake of about half its own size. He had succeeded in getting down nearly one half the length of his prey, head first, and was so completely gorged as to be incapable of moving. A few blows from a stout stick dispatched him, and the garter snake was withdrawn from his interior dead. The black snake measured 4 feet 8 inches in length."

Mr. F. N. Parker, of Newberry, S. C., also observes: "We have here a black and white snake we call the king snake, which will leave any other kind of food to eat a snake. There was one brought in town a few days ago with a much larger snake than itself hanging from its mouth half swallowed.

Locomotives.

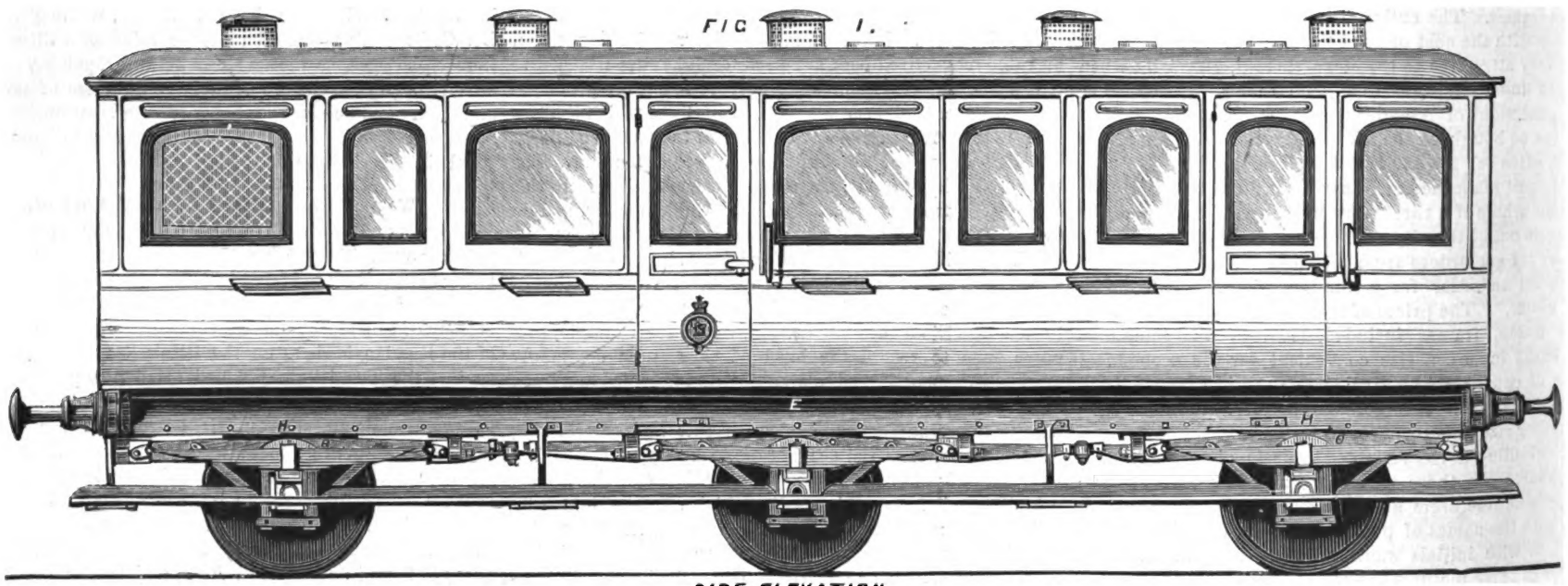
Mr. Price Williams lately gave some interesting data as to the power, performances, and consumption of coals of all the locomotives combined within the United Kingdom, and as an illustration of the extraordinary development of power, remarked that whereas originally it was only attempted to ascend the very slightest incline, the goods engines used on the Great Northern Railway had now sufficient power to just move up a gradient of 1 in 14; and these engines, when traveling at 30 miles an hour, developed 600 horse power. The number of locomotives in the United Kingdom were estimated by Mr. Williams at 12,994. They drew annually 205,600,000 tons weight of goods, 309,000,000 tons weight of carriages, and 530,000,000 passengers. The coal consumed he estimated at the enormous amount of 1,204,206 tons for passenger traffic, 1,924,000 tons for goods traffic, forming a total of 3,128,206 tons.

ENGLISH CAR TRUCKS AND AXLES.

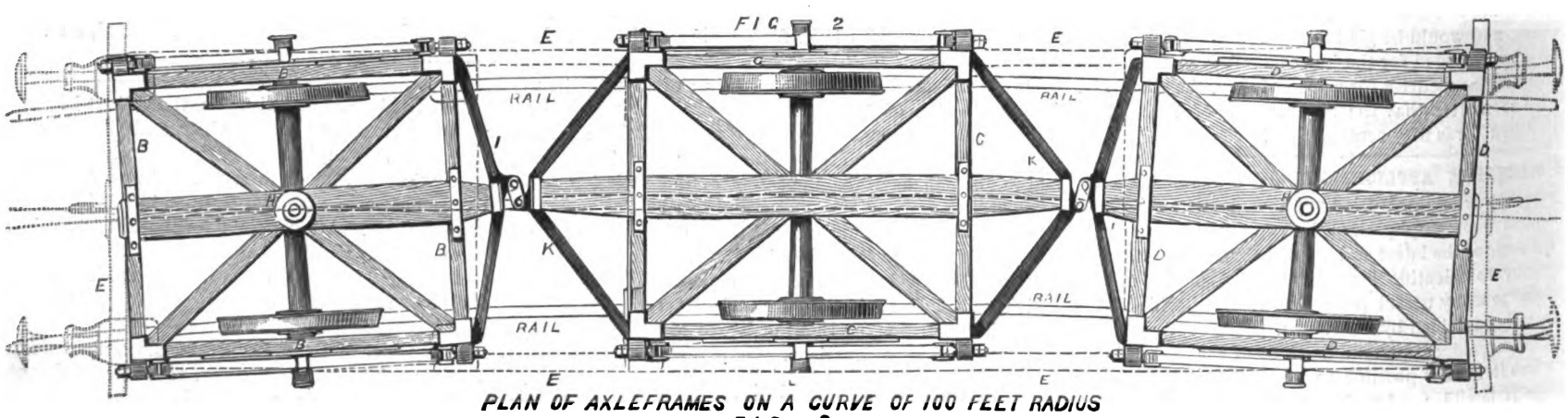
Notwithstanding the successful introduction of many American improvements on European railroads, the problem of constructing long cars adapted to sharp curves has apparently been a baffling one to English railroad engineers.

Cars of the "palace" type have, within the past few years, been gradually growing in favor abroad, and their advantages have at length, after a hard struggle, become properly appreciated; but still the simple plan of supporting the cars upon two independent trucks or "bogies," having the requisite flexibility, has failed to find favor, principally because of the strong and heavy framing necessary to carry the weight of the middle portion of the car, and also because each end truck may, in one sense, be regarded as in itself a vehicle with parallel axles, but with a short wheel base, and therefore having no advantage over the short cars commonly used.

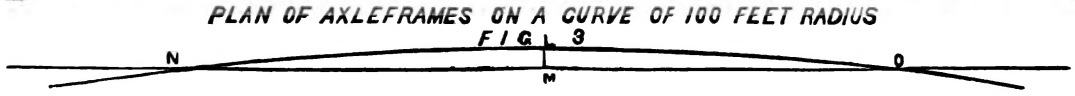
Our illustrations give a view of a royal saloon carriage on the Southwestern Railway, England, the plan of the axle frames showing the application of what is known as Cleminson's flexible wheel base system, a mode of construction invented by Mr. James Cleminson, of Westminster. This is an ingenious attempt to combine the advantages of long carriages with the facility of rounding curves possessed by short ones, and certainly has the appearance of possessing one very essential quality, that of lightness. It is well understood that the proportion of dead weight to carrying capacity is diminished by increasing the length of the cars, and Mr. Cleminson has endeavored to make the most of this by adhering to a central pair of wheels instead of adopting the heavier framing required in their absence. The London *Engineer*, from which we obtain the following particulars, speaks highly of this system, and mentions a number of roads on which it has been introduced. The means of passing round the sharpest curves with the axles always normal and radial thereto, whatever its radius, are secured by so attaching the axles to the carriages and to each other as to permit them to adapt themselves automatically and with truth to the varying conformations of a railroad. This is effected as follows: The axles, with their axle boxes, guards, and springs, H, are mounted in frames, B C D, Figs. 1 and 2, separate from the main under frame, E. The end frames, B and D, have central pivots around which they swivel freely, while the middle frame, C, is at liberty to slide transversely to the main under frame, E, through a range equal to the versed sine, L M, of an arc, N L O, the chord of which equals the wheel base, N M O (see Fig. 3), and finally the frames are connected to each other by the articulated radiating gear, I and K. The action of the combination is simply thus: When a vehicle enters a curve, the middle axle and frame, C, move transversely through the versed sine of the wheel base arc, and, in doing so, cause the end axles and frames, B and D, to swivel around their pivots, H, so that all the axles assume positions of radii of the curve. The *Engineer* states that for a very long carriage, say 80 feet, eight wheels would be employed, with a modification of the arrangement illustrated.



SIDE ELEVATION.



PLAN OF AXLEFRAMES ON A CURVE OF 100 FEET RADIUS



CLEMINSON'S FLEXIBLE WHEEL BASE SYSTEM.

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THE GATLING GUN ALOFT.

In the old days of yard arm to yard arm naval conflicts, it was always customary to station good marksmen in the tops, their duty being to pick off the enemy's officers and disable the crews of the spar deck guns. Other men stationed aloft were provided with hand grenades, small explosive shells, which they threw upon the deck of the hostile vessel. The light mitrailleuse now used on men-of-war is a far more formidable means of offense than either single rifles or grenades, and, in fact, it renders impossible the working of exposed guns on any craft within the range of the hail of bullets which it projects.

Our engraving, from the London *Illustrated News*, represents an American Gatling gun as arranged for use in the main top of a British man-of-war, a significant example of the avidity with which foreign nations adopt the inventions which originate on this side of the Atlantic, especially when the same are of superior value for war purposes. The gun, as here depicted, consists of a number of gun barrels, which may be as many as ten, fixed around a main shaft, which is also combined with a grooved "carrier," to hold the cartridges, dropped into it one by one; and with a cylinder, in which are cut slots for as many gun locks as there are barrels to be fired. The whole of the above apparatus is raised or lowered, or moved to the right or left, by working a handle at the side. There is a drum fixed on the top, containing 350 cartridges, set in rows; this is so arranged as to be the feeder, by dropping the cartridges in succession into the carrier, from which they are shifted by lock action into the gun barrels, successively brought round with each revolution of the cylinder. The caliber of the gun barrels is 0·45 inch; they can be charged and fired with great rapidity, discharging five or six shots in a second.

A Cubic Mile of Humanity.

A fanciful genius suggests that it is now time to celebrate the completion of the first cubic mile of humanity, and gives a calculation to show that the bodies of all mankind, from the first Adam down to the Adams just born, if closely packed without diminution of volume, would exactly fill that space. Here are his figures, which our young mathematicians who have nothing else to do may verify if they can.

According to the orthodox chronology the world has been inhabited about 6,000 years, or 170 generations. Its present population is about fifteen hundred millions; but this density of population must have been slowly reached, since all are descended from an original pair. Consequently he takes half the number of the present seven hundred and fifty millions, as the average population of the world from the beginning until now, making the aggregate of human bodies during the 170 generations, 127,500 millions. Since many die in infancy, and half are women, the average weight of each body is taken as seventy-four pounds. The aggregate weight of all mankind to date must accordingly be 4,212 million tons, or a little more than the weight of a cubic mile of sea water. Since the human body, with the lungs not inflated, is a trifle heavier than sea water, our calculator assumes that his estimated 4,212 million tons of humanity would fill the same space as 4,205 million tons of sea water, or precisely one cubic mile.

Taking the same figures and exercising the same freedom in striking averages, the mathematically inclined may deduce any number of amusing results. For instance, assuming the average length of humanity to be a little under four feet, the bodies of all mankind, living and dead, placed end to end, would just make a bridge from the earth to the sun!

Hair Hygrometer.

In a new hair hygrometer, by Dr. Koppe, of Zurich, the hair, protected by a sheet metal frame, is stretched by a small German silver spring, which can bear ½ grain. In adjustment, a cloth covered frame, after being moistened with water, is pushed into the back wall of the apparatus. In less than a minute the pointer rises to 100; or it can be exactly brought to 100 by turning with a watch key the shaft to which the end of the hair is attached. If the moist frame be now withdrawn, the apparatus soon shows the moisture of the surrounding air.

THE GATLING GUN IN A MAN-OF-WAR'S TOP.

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Communications.

Rapid Locomotive Building.

To the Editor of the Scientific American:

In your issue of the 23d ult. you invite a communication from some one interested in the fast engine building at this place. As I was one of the workmen I will endeavor to give you the facts. As to the time given by the papers, 8 hours, it is correct. Our master mechanic, S. H. Edgerly, through the daily papers invited all railroad men and others to come to the shop the evening before and inspect the work, which a great many did, and in the morning over 200 strangers were in the shop to see us commence. Most of them remained till the finish, and they can vouch for the time.

Our system of doing work in this shop I think is not surpassed in the world, as every hole in the boiler is not only drilled, but tapped at the same time by a tap with a drill point before the sheet is rolled or flanged, and every hole in the frame, cylinders, boxes, and in fact everything, is drilled and reamed by machine work before the parts come to the erection shop. So we have nothing to do but drive the bolts. D. Z. A

Jackson, Mich.

Corroded Cannon Primers.

To the Editor of the Scientific American:

A box of corroded cannon primers was lately sent from the U. S. Arsenal, at West Troy, for examination. The corrosion presented a white powdery appearance, dotted in a very few places with green. On examining the cross-section, the metal was found to have altered in color in those portions corresponding to the white coating; the sheet brass, of which the primer cases were made, in such spots taking a deep copper color. That this change in the metal began on the interior was evident from some sections giving two distinct layers, with the unaltered brass on the outside. The white coating gave the usual reactions for oxide of zinc, while the green spots (very few in number) proved to be basic carbonate of copper. The primers having been stored since the war in an exceedingly damp building, the basic carbonate of copper is easily accounted for; and in all probability the white incrustation takes its origin from the action of the niter in the gunpowder (aided by moisture) upon the zinc in the brass, niter being a powerful oxidizer. This is rendered more probable by the fact that the powder is badly caked under those areas most corroded. The zinc being thus removed from the alloy, the metal necessarily becomes too brittle to allow of the primers being used.

Troy, N. Y. WILLIAM P. MASON.

A Question for Locomotive Experts.

To the Editor of the Scientific American:

Referring to my question in your columns of the 9th, and to Mr. Holmes' answer in your issue of the 30th inst., of course we all know that by reducing the piston area one half and doubling the length of the cranks of a locomotive, we do not gain or lose in power theoretically.

The question involves simply the durability and efficiency of the machinery. Our present large pistons impose a stress of 16 to 20 tons upon each crank pin at each alternate impulse of the pistons, and a proportionate stress upon the main bearings and guides. Now the question is, would it not be better practice to reduce this stress just one half, provided it could be done, as indicated in your issue of the 9th inst.? Would not this change increase the efficiency and durability of locomotives?

Mr. Holmes should have taken one half of the area instead of one half the diameter in his figuring (this was an oversight probably); by doubling the result, however, we have the correct answer. F. G. WOODWARD.

Worcester, March 31, 1878.

A Remarkable Galvanic Battery.

At a recent meeting of the Society of Telegraph Engineers, London, Dr. Burns' pneumatic battery was exhibited. This remarkable battery, as described in *Engineering*, is a peculiar form of the ordinary bichromate of potash cell. The negative pole is a zinc plate; but the positive pole instead of being a carbon plate is, in this form, a compound metallic plate formed by coating a copper plate with lead and facing one side with a plate of platinum. A section across such a plate would, therefore, pass through lead, copper, lead, and platinum in succession. The backing of copper to the platinum plate diminishes the resistance of the positive pole, while the lead protects the copper and solder from the acid solution. This is made by adding 12 ounces of bichromate of potash and 1 pint of sulphuric acid to 5 pints of water. The peculiarity of the cell, however, consists in an arrangement by which air can be pumped into the liquid. This is effected by having a perforated tube running along the bottom of each cell, and a hand syringe or bellows in connection with it, so that air forced into the tube escapes through the perforations into the liquid. This circulation of air gives rise to an extraordinary strength of current in the circuit of the cell, and to an equally extraordinary development of heat within the cell. Ten of the cells exhibited heated a stout platinum wire, 30 inches long and No. 14 B.W. G., to a glowing heat on pumping. The heating took place gradually as the pumping went on, and the wire cooled again to its dark state when pumping was left off. Some idea will be formed of the great heating power here displayed, when it is remembered that it takes 70 or 80 Grove's elements to heat a similar length of No. 18 or 24 B. W. G. platinum wire. The battery was, in consequence of its heating effect, introduced by Dr. Burns for the actual cautery, and an important operation has recently been successfully performed in London by its means. The same 10 cell battery even yielded a small but beautifully brilliant electric light with two carbon points. The electromotive force of each cell is about 1·7 volts, and the internal resistance, according to Mr. Preece, is by the ordinary instruments immeasurably small.

Why the pumping of air into the cell should increase its current strength so much, is a problem not yet decided. In order to determine whether it was due to some chemical action of the air, or to its merely mechanical action, Mr. Ladd pumped air, oxygen, and hydrogen one after another into the cell, but no difference was observable in the action of the cell It was all the same which gas was pumped in; and hence he concluded that the effect was due to a mechanical cause. Since either an increase of electro-motive force or a diminution of resistance will produce an increase of current strength, Mr. Preece measured its electro-motive force when quiescent and also on pumping; but no difference could be detected. He then attempted to treat its resistance in the same way, but failed to obtain a measure of it by ordinary means, it being so small. It was the opinion of Dr. Burns that the effect was due to a depolarizing influence of the air on the plates of the cell, but Mr. Preece's experiments veto that explanation. A notable point about the cell is the high temperature developed in it by the pumping; it being impossible, after a time, to handle the cell because of its hotness. The explanation offered by Mr. Preece is that this heating of the cell reduces its internal resistance; but may it not rather be that the heating itself is due to the abnormal chemical action going on in the cell, and necessary to produce the powerful current?

Professor Adams suggested that it might be due to a circulation of the liquid, promoted by the air, so that fresh acid came into contact with the zinc plate. This would have the double effect of increasing the chemical action and diminishing the resistance. Mr. Preece argued against this explanation, that if it were due to fresh acid it would be an instantaneous effect, whereas we had seen the heating of the platinum wire, *i. e.*, the rise of current strength, keep pace with the pumping.

Mr. Ladd was inclined to attribute the effect principally to the positive pole of the cell, and the diminished resistance it offered; and Mr. H. Edmunds, Jr. (who exhibited the battery on behalf of Dr. Burns), said that Dr. Burns also referred a great deal of the efficacy of the cell to the positive pole. He mentioned that Dr. Burns had obtained remarkable results by using dilute sulphuric acid as the exciting solution, and dispensing with an air pump, but retaining the compound plate.

Wheat Analysis.

The following is an analysis by Boussingault, the celebrated French chemist, on the ashes of wheat. Fifteen hundred pounds of wheat having been reduced to ashes, and subsequently weighed, there was found to be thirty-three pounds of ashes, which on analysis yielded the following substances:

	lbs.
Phosphoric acid	15·51
Sulphuric acid	0·33
Chlorine	trace
Lime	0·95
Magnesia	5·25
Potash	9·73
Soda	trace
Silica	0·44
Moisture and loss	0·79
Total	33·00

There is no better way to test wheat than to grind it into flour, and turn this flour into bread. An analysis, therefore, of good sound bread will doubtless prove interesting:

Water	32·5
Gluten and nitrogenous substances	8·8
Modified starch, sugar, gum, etc	57·6
Mineral salts	1·1
Total	100·0

The small proportion of mineral constituents in this analysis is due to the absence of bran in the flour with which the bread examined was made. The nutritive properties of bran are little understood by the general public. We know that gluten is the chief constituent of nourishing bread, and also that mineral matter is necessary to our system; and we find too often that bran is richer in both gluten and mineral constituents than flour itself, as shown by the following analysis:

	Wheaten flour.	Bran.
Gluten	11·46	13·80
Starch	73·52	53·20
Oil	0·00	2·50
Woody fiber	0·68	11·50
Mineral matters	0·84	6·14
Water	13·50	12·86
Totals	100·00	100·00

Of course this is caused by defective grinding, the larger part of the gluten escaping in the bran, the very thing that should be guarded against—the presence of 11·50 of woody fiber is certainly much against its being retained in wheaten flour for the purpose of bread making, and it is a matter of congratulation not only to the consumer, but miller as well, that means have been devised for separating the greater part of this woody fiber from bran, and thus rendering the latter better available for more general use. The mineral constituents in which flour is so poor and bran so rich are precisely those which it is essential we should absorb, inasmuch as we find them present in the human body. It is therefore necessary, in order to make good nutritious flour, that only the woody fiber, or outer bran, should be removed from the berry in the process of grinding, so as to retain all the nutritive constituents of the grain. This woody fiber is the chief cause of the sudden blunting or glazing of the millstones, and the process which will entirely remove or loosen it, by decortication or any other means, is a desideratum in milling at the present time and would make a fortune for the inventor.

Coal-Dust Explosions.

We have on several occasions chronicled in the SCIENTIFIC AMERICAN accounts of the burning of lumber-working factories, by the ignition and, as it were, sudden explosion of fine particles of wood floating in the apartments or flues of such establishments; also the burning of flour mills by the ignition and explosion of fine flour floating in the chambers or passages of such mills. Mr. W. Galloway, an English writer, gives the following in relation to coal-dust explosions.

Some facts have been brought forward which prove that, in certain cases, coal-dust has been ignited under the influence of an incandescent furnace, or, simply, by a lamp; but the effects have been of an unimportant nature. There have been several instances in which sudden inflammation, or even true explosion, has been produced by emptying a basketful of very dry coal-dust near a fire of live coal like that of a steam boiler; and likewise, when a handful of coal-dust has been thrown into the fire, not only combustion, but instant conflagration, has taken place. We believe that this circumstance is not conclusive, and that it is more intimately connected with the ordinary conditions of combustion.

At the meetings of January 2 and February 6, 1875, M. Baretta stated several instances of the inflammation of coal-dust without a shot, and without the presence of fire damp. No trace of fire damp had ever been observed during the twenty-two years in which workings had been carried on in the great seam of No. 1 Pit, Montmartre. Two accidents happened there in different places in 1869, in consequence of the inflammation of coal-dust. The temperature of these two places was not more than 64·4° Fah. (18° Cent.); they were very dry, and had been cut through coal reduced to a state resembling priming-powder—one was in the ninth, the other in the tenth slice. The lagging, or garniture, of the timbering consisted of closely joined planks, with their joints carefully stuffed with hay, being similar in this respect to that of many of the other places. A thick smoke, due to the particles of dust suspended in the air, filled the working place while the hewers were at work, and long afterwards; it had a disagreeable smell, and produced a very distressing dryness in the throat, so that the hewers could hardly work for ten minutes at a time, and then they were obliged to come out to breathe the pure air at the entrance of their stall, in the haulage level, where there was a strong air-current. Naked lights were used at a distance of 3 or 4 feet (1m. to 1·50m.) from the face. A sudden fall of small coal took place at the face where the hewers were at work; it was not of much consequence in itself, but sufficient to cause an eddy in the air of the stall. The coal-dust took fire at the lamps, produced a slight detonation, and the conflagration extended to a distance of 7 or 8 yards (7 or 8 meters), with a red flame. The hewers were slightly burnt about the arms, and had the hair of their heads and beards singed.

The circumstances were identical in the two cases.

Again, in 1871, at the same pit, on the surface, coal-dust was kindled by contact with a fire grate at a distance of 13 feet 1½ inch (4 meters) from a sieve on which a basket of coal was being emptied. A sorter was slightly burned about the hands and body.

Another explosion occurred under the coal-tips on the surface at Montmartre pit in October, 1874. A tub, or tram, full of very small coal was being overturned on the screen while a light current of air carried away the dust, which took fire at a small fire grate at a distance 5 feet (1·50m.) from the foot of the screen; an explosion followed, and the red flame burnt a sorter so severely about the hands as to incapacitate him from work for eight days. This man was standing about a yard (1 meter) further from the screen than the fire grate, and in the direction towards which the wind was blowing. A wagoner who was standing 7½ feet (2·50m.) still further off, in the same direction, had his hair slightly singed.

We could not here recount all the discussions that have taken place at the monthly meetings about these different communications, but we shall quote the two following opinions as a kind of summary of them:

M. Gonthier holds the opinion that all the facts concerning the explosion, or rather, sudden combustion of coal-dust, that have been related for some time past, far from supporting the opinion that coal-dust greatly aggravates an explosion of fire damp, and propagates it to a distance, tends rather to demonstrate the contrary proposition, since the whole of such explosions have been of a very feeble nature. He admits, certainly, that coal-dust suspended in the air, or deposited on the walls, will, in taking fire, augment the intensity of an explosion of fire damp to a certain extent, and even transmit the flame of one reservoir of fire damp to another situated at a short distance off; but all the facts brought forward show that coal dust cannot produce a

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severe explosion in a district in which there is no fire damp. The burns which workmen sustain from the combustion of coal dust are also less serious than those of a true fire damp explosion

M. Pinel thinks that the intensity of an explosion of coal-dust suspended in air varies according to the intensity of the source of heat that ignites it. If it is originated by a lamp, as in the case cited by M. Baretta, the flame does not extend far; if by a shot, it may be drawn out to 13 yards (12 meters), as was the case at the Béraudière mine, or to 38 yards (35 meters), as at Campagnac; if by an explosion of fire damp, the source of heat being more active and of greater magnitude, the deflagration of the coal-dust is much more considerable, and might become imposing. It is not, therefore, fair to conclude, from the small importance of an explosion of coal-dust initiated by a lamp or a shot, that in an event of the same kind, initiated by an explosion of fire damp, the coal-dust would still play an unimportant part.

EXPERIMENTS OF THE COMMITTEE.

At the monthly meeting of February 3d, 1872, a committee was appointed to study the three following hypotheses:

(1) Coal-dust alone, even in the absence of inflammable gas, is susceptible of producing an explosion under the influence of any source of heat whatever

(2) Coal-dust alone is not susceptible of producing an explosion, but it ignites under the influence of the heat set free by an explosion of fire damp, and serves only to propagate the explosion by carrying the flame to other reservoirs of gas.

(3) The influence of coal dust is *nil*, or nearly so.

The work of the committee consisted, therefore, in making direct experiments to ascertain whether coal-dust is inflammable, and under what conditions; whether ignited coal-dust can propagate inflammation in a gallery charged with coal-dust, and under what conditions.

Although the experiments of the committee were not completed, and did not lead to very conclusive results, we believe that the manner in which they were conducted, and the results obtained, ought to be indicated.

It was agreed that the first experiments be made without gas, and those afterward with a larger or smaller proportion.

The Saint-Etienne Colliery Company placed a piece of ground at the disposal of the committee, and caused an artificial gallery, about 33 feet (10 meters) long, to be constructed along the side of a wall. This gallery was formed of beams of sawn timber, 6½ feet (2 meters) long, placed with one end against the wall and the other against the ground, so as to form a right-angled triangle with sides of 4 feet 7 inches to 4 feet 11 inches (1·40m. to 1·50m.); sufficient stability was given to the whole structure by piling sods on top of the beams. A movable panel was reserved in the middle of the length, of such a kind that, when it was in position, the whole formed one gallery, 33 feet long, whereas, when it was removed, two galleries, each 13 feet (4 meters) long, were obtained. A ventilator was connected with the end of the first gallery, in which a bed of fine coal-dust, 1½ to 2 inches (4 to 5 centimeters) thick, was laid down. It was intended to ignite this dust by means of the detonation of a cartridge containing 1¾ oz. (50 grammes) of powder. The cartridges were made with paper or with lead, as was necessary; in the latter case a small piece of lead pipe was employed, having a diameter of ¾ inch (0·02m.); and after the powder and fuse were introduced, its two ends were flattened. In this manner an explosion was obtained.

The following series of experiments were made on the 29th of February, 1872:

First Experiment.—A leaden cartridge placed in the second gallery, which did not contain coal-dust, produced a small explosion, accompanied with a clear white flash, exactly like that which bursts from the barrel of a gun and disappears immediately.

Second Experiment.—A similar cartridge was placed in the first gallery at a distance of 6½ feet (2 meters) from the open end, which was closed with a wooden door. The match was ignited, the ventilator set in motion, and fine coal-dust was thrown upon its blades. At the moment of explosion the door was overturned, and a large outburst of red flame, resulting evidently from the combustion of coal-dust, was seen to take place from below upward.

Third Experiment.—Two paper cartridges of 1¾ oz. (50 grammes) were placed in the first gallery; the ventilator was set in motion; and, again, there was a considerable quantity of red flame produced.

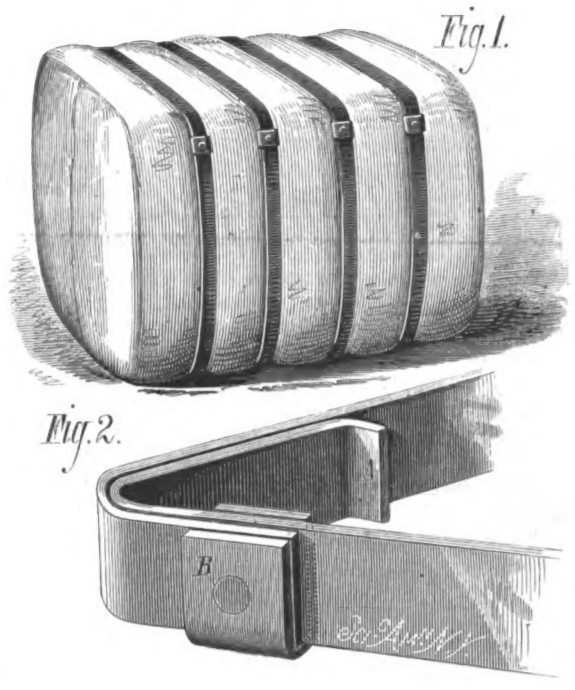
It could be concluded from these trials that coal-dust, suspended in air, is ignited under the influence of an explosion of gunpowder; and it was important to ascertain whether dust inflamed in this way could communicate combustion to any considerable distance.

Has Electricity Weight?

Mallet has come forward with an experiment, apparently corroborative of that of Pirani, described in the SCIENTIFIC AMERICAN of February 9, 1878, purporting to show that electricity has weight, or at least is under the influence of gravitation. He takes a straight copper wire three feet long, bends the ends downward, and suspends it at the middle to one of the arms of a delicate balance, while the bent ends dip in mercury. When the current of a moderately strong battery (say ten Grove cells) is passed through the wire by the intervention of the mercury, the arm to which the wire is attached, although accurately balanced by a counterpoise, will sensibly tend downward, notwithstanding the resistance produced by the buoyancy of the mercury. The conditions of the experiment, however, demonstrate that gravitation has nothing to do with it, and that it is merely due to the law of attraction of electric currents. These conditions are that the wire must be placed in an east and west direction, and that the current is sent in the same direction. According to Barlow's theory, electric currents travel in the earth's crust from east to west, and are the true cause of the direction of the compass needle, which, according to the law discovered by Oersted, places itself always at right angles to electric currents, while magnetic declination and variation are due to the direction and changes of these currents. Ampère discovered that currents passing in the same direction attract one another, and therefore that the subterraneous earth currents exert an attractive effect on all conductors through which electric currents pass from east to west; hence the conducting wire goes down, while the electric action is added to the gravitation which was balanced by the counterpoise. But Ampère also discovered that electric currents running in opposite directions repel one another; *ergo*, when the electric current is passed through the suspended conducting wire from west to east, it must be repelled and driven upward against gravitation, and this deduction is fully verified by experiment, as in this case. The counterpoise goes down, and the balance may be made to oscillate by alternately reversing the currents; which proves that the theory based on the laws discovered by Barlow, Oersted, and Ampère, offers a correct explanation, without recourse to the novel hypothesis that electricity has weight.

IMPROVED BALE TIE.

Our engraving represents a new bale tie for cotton or hay bales, which may be easily applied, and which dispenses with the use of buckles. One end of the band is bent at right angles to form a hook, A, that engages the bale covering when the band is fastened around the bale. B is a V shaped piece of iron, that is riveted to the opposite end of the band, and is capable of receiving the free end thereof, as shown.



IMPROVED BALE TIE.

The manner of using the tie is as follows: The bale being pressed in the usual way, the hook, A, is placed against the side of the bale at some distance from the point of fastening. The end, B, is then carried around the bale and over the hook, and is placed under the band. The hook, A, assists in holding the band as it seizes fast upon the bale covering, enabling the band to be drawn tightly over. The device forms a strong, easily applied, and reliable fastening.

Patented January 29, 1878. For further information address Messrs. Rodecker & Lenard, Waco, Texas.

Water Filters.

At a recent meeting of the Society of Engineers, London, a paper was read by Mr. J. Walter Pearse, on "Water Purification, Sanitary and Industrial." In his opening remarks, the author observed that, until the metropolis was furnished with a supply of water from pure sources, private filtration was necessary, and chemical purification was required, as well as mere mechanical filtration. Great diversity of opinion existed as to the value of the various substances used as purifying media, and also as to the form of filter.

The first record of a water filter was in 1790, when Johanna Hempel employed porous vessels; and in the following year the ascending principle was first mentioned. Vegetable charcoal as a filtering medium was first named in 1802, animal charcoal in 1818, and solid blocks in 1834. Turning to the modern practice of filtration, the author observed that Atkin's system embodied the last named principle, finely divided charcoal being agglomerated into porous blocks. The advantage of employing carbon in that form was that the impurities were arrested on the surface, and were easily removed.

Major Crease, R.M.A., compressed loose animal charcoal in a granular state, between plates, by means of a screw, the amount of compression being determined by the degree of impurity in the water to be filtered. Major Crease's system is adopted in the army and royal navy.

The chief characteristic of Mr. F. H. Danchell's filter was that the ascending principle was used, so that impurities, instead of lodging on the top, fell back on to the bottom of the tank. The Sanitary Engineering and Ventilation Company use mineral carbon as a filtering medium, and cause their cistern filter to be cleansed by the inrush of the supply, and also by reversing the flow. In the Silicated Carbon Filter, mineral charcoal is used as the filtering medium, the main supply filter having three slabs with layers of coarse and fine granular carbon between. In Professor Bischoff's spongy iron filter, the iron exerts a powerful influence on the water, impregnating it with iron, which is afterwards oxidized and arrested, leaving the water pure.

M. Le Tellier's hydrotrimetric purifier was described as removing the hardness from water by throwing down the lime, which was afterwards intercepted by filtration through charcoal. A jet of lime water is made to mingle with the stream from the supply pipe, and the precipitated lime is afterwards arrested by filtration. M. Le Tellier has also invented a high pressure apparatus on the same principle, for dealing with large bodies of water used in manufacturing processes, and for purifying the feed water of steam boilers above 20 horse power. On the same bed plate are fixed two close vessels, the smaller containing the lime water or other reagent, and the larger the mechanical filter for arresting the precipitate, the two vessels being connected by an injector. The supply, which must have a pressure due to a column of at least 10 feet in height, enters by an inlet pipe, and most of it passes through the injector into the filtering chambers. A portion, however, descends another pipe, and issues through perforations at its lower end, keeping a disk, which is supported by a spiral spring, in a state of continual trepidation, and thus assisting the combination of the water with the reagent, previously inserted. The rush of the main supply through the injector draws alongs with it the lime water from a small pipe, and the two pass together into a vertical tube, which is traversed by pins set alternately at right angles to each other, for bringing about a more intimate union. A valve also admits atmospheric air for aiding in the process. Arrived at the filtering chamber, the lime is thrown down, to be removed periodically through a cleaning pipe, and the pure water passes through the filter tubes into the purified water reservoir below, whence it is drawn through a pipe by a pump or injector in connection with the engine and the boiler.

The filter proper consists of wrought iron tubes, perforated with holes, and covered by disks of felt which are compressed between cast iron plates screwed up with a gun metal nut. The lower ends of the tubes are conical, and fit into sockets screwed into the plates which separate the unfiltered water chamber from the filtered. The number of the tubes varies with the size of the apparatus; but the filtering area of each tube is very large in comparison with the space it occupies, being equal to the height multiplied by its circumference. Each tube may be lifted out of its socket for cleaning or replacing. A cleansing of the whole apparatus is also effected by turning steam into the outlet pipe, which heats the water in the lower chamber and forces it through the tubes and felt, expelling any impurities which may have collected there, to be washed away by rinsing with clean cold water. This apparatus is largely employed by manufacturers on the Continent; and when used for potable water a second filtering medium of vegetable charcoal is added. Mr. A. Durand Claye, director of the laboratory of the Ecole des Ponts et Chaussées, Paris, made some experiments with the Le Tellier filter purifier in 1875, and found that water of 24° of hardness was reduced to 5° after passing through the apparatus, while the solid residue was reduced from 3·31 grammes to 0·92 gramme, a gramme being equal to 15 grains.

Improved Propagation by Cuttings.

Peter Henderson described last winter, in the *Agriculturist*, an improved mode he was then using for the propagation of geraniums. His object was, in the first place, to avoid the exhaustion of the parent plants by the removal of cuttings abruptly; and, secondly, to make sure work. He takes the young shoot which is to be used as a cutting, and snaps it short, leaving it hanging by a small portion of the bark.

This shred is sufficient to sustain the cutting, without any material injury from wilting, until it forms a callus, which precedes the formation of roots. In from eight to twelve days it is detached and potted in two and three inch pots. It is rather less shaded and watered than ordinary cuttings, and forms roots in about eight to twelve days more. Last fall Mr. Henderson propagated about 10,000 plants of the tricolor class without losing one per cent. With the common method he thinks he would have lost fifty per cent. This mode is applicable to the abutilon, begonia, carnation, cactus, lantana, oleander, etc., by using young unripened shoots. If the shoot does not break, but simply bends to a knee, a knife may be used for cutting about two thirds through.

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ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, April 13, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	8 17 eve.	Saturn rises	4 36 mo.
Venus rises	3 36 mo.	Uranus in meridian	8 24 eve.
Mars sets	11 00 eve.	Uranus sets	3 16 mo.
Jupiter rises	2 12 mo.	Neptune sets	7 35 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	10 33 eve.	Sirius sets	10 12 eve.
Regulus in meridian	8 34 eve.	Procyon in meridian	6 05 eve.
Spica rises	6 28 eve.	Aldebaran sets	9 58 eve.
Arcturus in meridian	0 45 mo.	Algol (2d-4th mag. var.) sets	10 41 eve.
Altair rises	11 46 eve.	Capella sets	1 51 mo.
Vega rises	8 10 eve.	7 stars (cluster) sets	9 41 eve.
Deneb rises	9 13 eve.	Betelgeuse sets	10 45 eve.
Alpheratz rises	2 46 mo.	Rigel sets	9 11 eve.

REMARKS.

Mercury is now brightest, setting 1h. 40m. after the sun, and 24° 45′ 2″ north of the west point, or 12° 27′ 6″ north of the sunset point. He is moving slowly eastward among the stars of *Aries*. Mars, with β and ζ *Tauri*, nearly form an equilateral triangle. Uranus is almost directly north 1° 11′ of Regulus. Algol is at minimum brilliancy April 10, 4h. 15m. morning, or 22m. before it rises. Hence, at rising, it will be of the fourth magnitude; also April 13, 1h. 4m. morning, and April 16, 9h. 53m. evening, 39m. before setting.

JUPITER'S SATELLITES.

I. Begins a transit April 14, 3h. 37m. morning, the shadow passing off of the planet at 4h. 32m. morning; reappears from behind the planet April 15, 2h. 59m. morning.

II. Begins a transit April 19, 3h. 57m. morning.

III. Begins a transit April 17, 3h. 46m. morning.

IV. This satellite happens to be at its greatest western elongation at the time of the beginning of the transit of III.

While observing Mars March 9, 6h. 42m. evening, Washington mean time, we saw a meteor far more brilliant than Mars suddenly flash out in R. A. 48°, Dec. 27° N. It described an arc of about 15° in 3 seconds, extending in a southern direction It left a beautiful train much the color of Mars, and did not explode or break up.

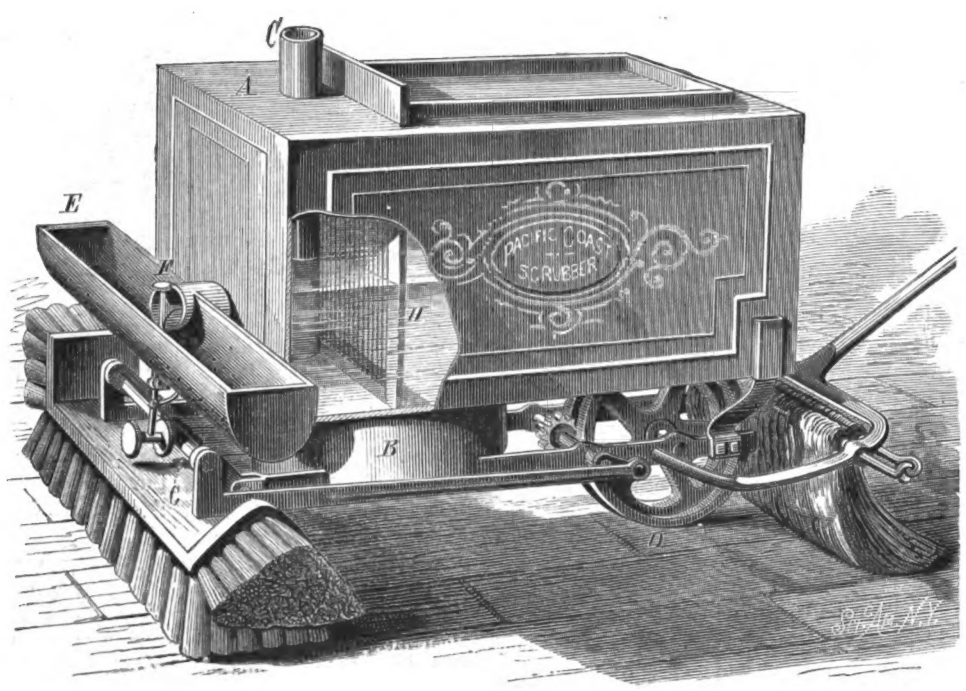
Telephone Re-invention Abroad.

A recent report of the proceedings of the French Society for the Encouragement of the National Industry, states that Count du Moncel recently laid before that association an account of a "remarkable improvement" in the telephone devised by MM. Pollard and Garnier, of Cherbourg. The improvement, which is considered as indicating great progress, is the discovery of the fact that the interposition of an induction coil in the telephone circuit materially augments the sound given by the receiving instrument. The credit of this invention is due to Mr. Thomas F. Watson, who patented it in this country on the 5th of December last.

IMPROVED SCRUBBING MACHINE.

The apparatus herewith illustrated is claimed to be a very efficient contrivance for scrubbing and mopping floors. It is self-acting, the operator having merely to propel it. It heats its own water, projects the same in spray form, works a scrubbing brush, and finally applies a mop or wiping cloth.

A is a water tank of any desired size, the top of which is closed by a suitable cover and which is mounted on a truck. Underneath is a box, B, in which the lamp or stove for heating the water is placed, the chimney passing through the tank and protruding above at C. At the front end of the frame is the scrubbing brush, to which a quick reciprocating scrubbing motion is imparted by the rock shaft, levers, and other simple mechanism, actuated by a pinion which gears with the wheel, D. This brush is so placed that it receives the entire weight of the front part of the machine. Connected with the forward end of the tank is a horizontal sprinkler, E, in the pipe leading to which is a valve, F, by means of which the supply of water, which escapes in divided form upon the brush, may be regulated. To the handle of the apparatus is secured a clamp for holding mop rags or cloths, as shown. When the machine is set in motion the valve, F, is opened by a nut on the short arm of a vertical rod striking against the shaft, G, as it reciprocates with the brush, and water from the tank is admitted to the sprinkler. A spring closes the valve when the machine is not in motion. A filter, H, serves to remove all dirt from the water as it passes to the supply pipe, and the mop clamp can be adjusted to either side of the handle arms, so as to run close to the side of the floor or surface which is being cleaned. The brush may be of any suitable size, shape, or material.



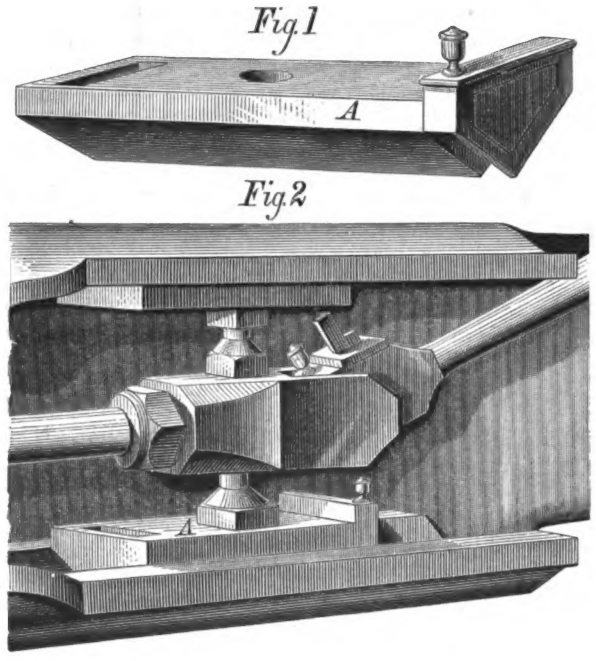
STOCKLEY'S IMPROVED SCRUBBING MACHINE.

Patented January 29, 1878. For further particulars address the inventor, Dr. A. F. Stockley, Lone Pine, Inyo county, Cal.

IMPROVED LUBRICATOR.

We illustrate herewith a new device for oiling engine slides. The oil is distributed to the guides or ways at every stroke in the form of a thin film. The lubrication is constant, and thus friction is reduced, dirt is prevented from remaining in the guides, and it is claimed that from one half to three fourths the oil generally used is saved.

The attachment is represented separate in Fig. 1, and in place at A, Fig. 2. It consists of a chamber which opens on the face and back of the slide, and in which a quantity of cotton waste is placed so as to project beyond the face. An oil receptacle, having a perforated bottom and filling aperture, is fitted to the chamber, with its bottom in contact with the waste. This being closed so as to prevent the entrance



AN IMPROVED LUBRICATOR.

of air, except through the perforated bottom, retains the oil until the waste in contact with the latter becomes sufficiently dry to allow a small quantity of air to enter the receptacle through the perforations, thus enabling a little oil to pass to the waste. It will thus be seen that the exact amount of oil required to lubricate the slide is supplied to the waste, which in turn constantly supplies it to the guides.

We are informed that waste has been used for three months in this lubricator without requiring change, and that the device has run for two weeks without renewal of oil, always keeping the parts cool. Patented through the Scientific American Patent Agency, December 11, 1877. For further particulars relative to sale of rights or of the patent, address the inventors, Messrs. Higgins & Devereux, Box 13, Manton, R. I.

Sulphurous Acid a Phylloxera Remedy.

Sulphurous acid, we learn from the *Journal de Genève*, is now being used in Switzerland with much success as a phylloxera destroyer. The gas possesses remarkable powers of diffusion, and permeates the soil with great rapidity. The means used consists simply in a copper reservoir containing some 220 pounds of liquid sulphurous acid, a number of smaller vessels of a capacity of about two quarts each, to the bottom of which perforated tubes are attached, and a sharp rod. The rod is driven into the earth near the vine to a depth of about 20 inches, and into the orifice the tube attached to one of the small vessels, previously filled with the liquid acid, is inserted. The earth is then packed around the pipe, and the stop cock admitting the liquid into the latter is opened for an instant. The acid escapes into the earth, and diffuses in gaseous form, completely, it is said, destroying all phylloxeras at the roots of the plant. As each small vessel is exhausted it is refilled from the reservoir. The holes are made about a yard apart.

New Agricultural Inventions.

Mr. J. M. Moore, of Ovilla, Texas, has patented an improved Cotton Hoe, which is twice the length of the ordinary chopping hoe, and which may be adapted to garden work by changing the large blade for a small one.

A novel Churning Apparatus, in which the power is transmitted by connecting rods to the cranks of a churn from an oscillating chair, so that the operator may attend to other occupations while churning, has been invented by Mr. E. P. Conser, of Monticello, Iowa.

A new device for Blowing Insect Powder has been patented by Mr. Michael Mark, of New York city. It consists of a tube in which works a spring-acted piston, and provided with finger and thumb rests for using the blower conveniently by hand.

Mr. D. M. Johnson, of Emerson, Iowa, has invented a new Plow Regulator, for attachment to plow beams to enable the plow to be adjusted to take or leave land, or to run deeper or shallower, without stopping the team. A lever pivoted to the plow beam shifts the point of draught attachment to one side or the other of the beam, raises or lowers it, and is capable of being locked in fixed position.

In an improved Cultivator, invented by Mr. P. J. Ward, of St. Mary's, Ind., the essential features are the means by which the machine is adapted to work over rows of tall plants, the axle being arched, and the tongue carried at a height sufficient to clear the plants. The handles are slanted laterally, so that the plowman may walk by the side of the row. There are also ingenious devices for locking the plow standards and for permitting the latter to swing backward when an obstacle is encountered.

An improved Seed Drill has been invented by Mr. O. N. Skaaraas, of Hale, Wis. At the bottom of the seed box are a number of feed wheels, which distribute the seed, through conductor spouts, to drill tubes cushioned by spiral springs, so as to avoid injury from obstructions. The mechanism is operated by a compound crank shaft and connecting rods, the power being derived as usual from a cogwheel on one of the supporting wheels.

Mr. J. W. Park, of Columbia, Texas, has invented an improved Beehive, which is made with a lower brood department having a bottom groove filled with bar soap, to prevent the entrance of moths. The honey box compartment is supported upon and separate from the brood chamber, and in the upper part of the latter are removable notched strips having comb pieces fitted to them.

New Process for Copying Tracings.

M. Pellet, of Paris, has recently devised a new process of reproducing drawings made on tracing cloth or transparent paper by the aid of photography, no camera being used. A process of this kind is already in use here which reverses colors, making dark lines appear white on a deep blue surface. M. Pellet's plan effects the opposite, as he obtains dark lines on a white ground, and the outline thus obtained may be shaded or colored by hand afterwards. The process is based on the property possessed by perchloride of iron of being decomposed by light and reduced to the state of protochloride. This last salt is not modified in a solution of prussiate of potash, while the perchloride is immediately colored blue. The paper on which the copy is to be made is sensitized by immersion in a bath of 100 parts water, 10 parts perchloride of iron, and 5 parts oxalic acid. The last may be replaced by an equivalent quantity of several other vegetable acids. If the paper is not sufficiently sized, a little dextrin, isinglass, or other similar matter is added. The paper is then dried in the dark, and may be kept indefinitely, always retaining great sensitiveness.

To reproduce the tracing the latter is placed over a dried sheet of the prepared paper, and a pane of glass over all. In summer, about 30 seconds, and in winter, from 40 to 70 seconds exposure to the sun is sufficient. In the shade, from 4 to 6 minutes, or if the day be dark and overcast, from 15 to 40 minutes may be required. The electric light acts efficiently, and the exposure varies according to the distance and intensity. The sheet, after exposure, is immersed in a bath of prussiate of potash (15 to 18 per cent in water), which immediately colors blue all the parts in which the perchloride remains unaltered. The sheet is then washed in plenty of water and dipped in a bath containing an 8 to 10 per cent solution of hydrochloric acid in water, which removes the protoxide. Washing and drying finish the operation.

A BAR of iron 70 feet long at a temperature of 32° Fah., if heated up to 212° Fah., expands 1 foot, or measures 71 feet.

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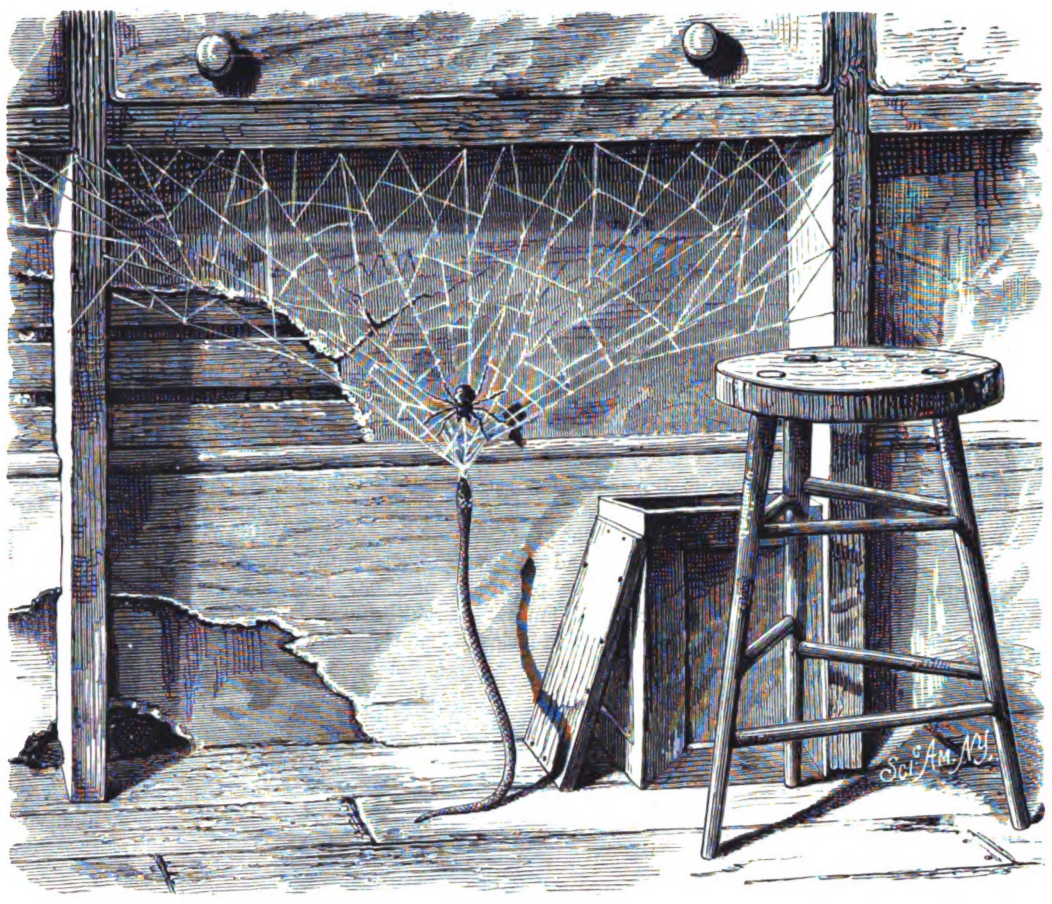
SPIDER ENGINEERING.

BY GEO. M. HOPKINS.

If Cleopatra's Needle, now about to be erected in London, were animated and capable of a thousand contortions, and if it were required of a man to suspend it vertically without mechanical or other aid, we would then have a case parallel with the one described below.

Some time since it was the fortune of the writer to witness the curious scene illustrated by the accompanying engraving. A snake about twelve inches long, of the species *Coluber eximius*, commonly called the milk snake, became in some manner entangled in the web of a common house spider, which was doubtless prepared for smaller prey. The spider, with the utmost energy, began to throw its web about the head and mouth of the snake until the latter became stupefied and unable to detach itself from the snare of its captor. Whether this state was altogether due to suffocation or to bites inflicted by the spider, I cannot state. The web which was formed with such great rapidity was, for a short distance above the head of the snake, twisted into a stout thread, which was connected with guys and stays running in all possible directions, and attached to the shelf above and brackets on either side. These guys the spider constantly strengthened, and also shortened, so as to raise the snake from the floor, gradually but steadily and surely. The snake, although moving, seemed to be incapable of resisting the operations of the spider, and was raised until only about one fourth of its length rested on the floor.

It would be interesting to know how the affair would have terminated had there been no interruption. The raising process continued for several hours, and the snake was finally released by one of the uninterested.



MILK SNAKE AND SPIDER.

Gravity Indicator.

A new apparatus for experimental verification of the laws of falling bodies is described in the *Journal de Physique*, by M. Lebourg. A flattened cylindrico-conical weight, guided in its fall, like that of General Morin's apparatus, carries, instead of a style, a vertical tuning fork, furnished with a short and stiff metallic wire. The weight falls down a rule, graduated on one of its edges, and covered with smoke black. The tuning fork is set in vibration automatically at the commencement of its fall, and it inscribes on the fixed rule a sinuous line, inspection of which affords an easy demonstration of the laws of the fall of bodies. By mounting on the apparatus several tuning forks one may compare together their number of vibrations, and even determine the absolute height of the sound produced.

THE ALGERIAN PALACE AT THE PARIS EXPOSITION.

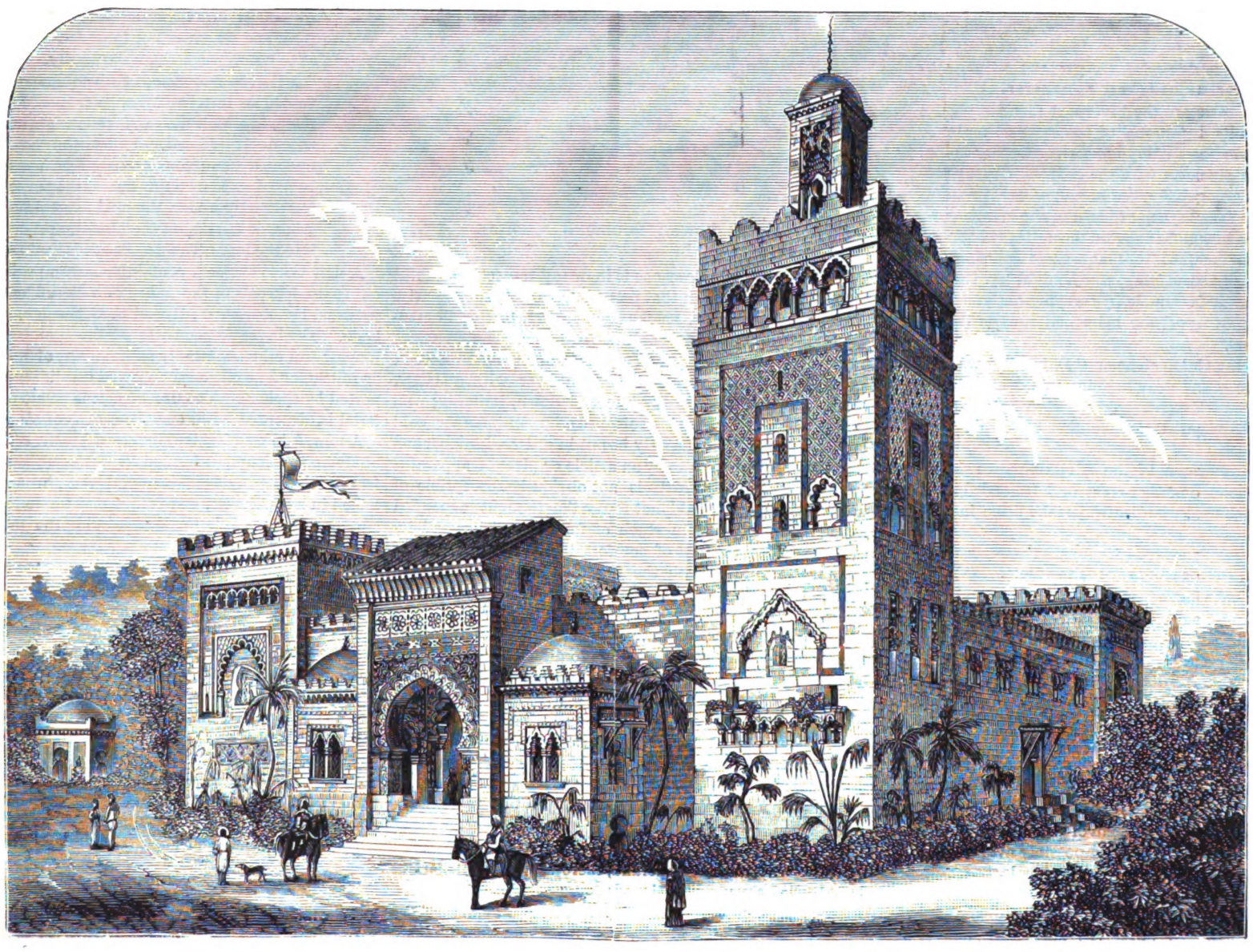
The Algerian palace, on the grounds of the Trocadéro, is now nearly completed, and will form one of the finest of the exposition buildings. The plan is eminently appropriate, and the tiles and mosaics used so lavishly in the decoration are fac-similes of those employed in ancient Moorish palaces, rendering the structure an interesting architectural study as well as an ornament to the exposition grounds. In the interior are a courtyard and fountain, around which run the courts which will contain the Algerian exhibits. The accompanying engraving, which we copy from *Engineering*, conveys a good idea of this handsome building.

Mansillian Science.

As an example of how easy an affair it is to invent new sciences in this progressive age, Mr. Richard Mansill's theory of planetary me teorology is monumental. Given a scrapbook of records of meteorological phenomena, a nautical almanac, and a vivid imagination, and where is the scientist who cannot propound an entirely new and original theory to account for every vagary of the clerk of the weather? Mr. Richard Mansill, however, advances beyond this goal of the average intellect, and to the above adds an electrical hypothesis, whereby he galvanizes into existence the defunct science of astrology, besides a remarkable amount of information the entire novelty of which no one will, for a moment, dispute.

"The base of the system," he says, "is that all planets, comets, and satellites go through a reversed change of motion, volume, and density at their perihelions and aphelions," and this is due to "reciprocating electric currents or lines that exist and undulate between the planetary bodies, and which currents are used to carry on these planetary changes with." When these passages occur the electric line which exists and undulates and reciprocates causes volcanoes and earthquakes, tidal waves, cholera, and epizoötics, besides other evils too numerous to mention, all, however, distantly related to the fact that the earth is an "explosive globe," which is balanced by motion, and that that motion is "the equivalent of cohesiveness." All of which, so far as any knowledge we possess to the contrary regarding electric lines and explosive earths, may be quite true.

KRUPP'S establishment at Essen employs in the foundry alone 8,500 men. In the works are 298 boilers and as many steam engines, having together 25,000 horse power.



THE ALGERIAN PALACE AT THE PARIS EXPOSITION.

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Curious Telephone Experiments.

In a note to the French Academy. M. Brequet says that all the points of the telephone—the handle the binding screws, the shell, etc., as well as the plate, may enable one to hear sounds. He demonstrates this with the string telephone. Attaching the string to any point of the Bell telephone, and using the parchment membrane, one may easily correspond with a person using a Bell telephone. Thus, by attaching several string telephones to a Bell telephone, several persons may hear the messages simultaneously.

To render string telephones more practically useful, M. Brequet fixes to the center of the membrane two or several strings meeting there at an angle. The sound carried by one of them is propagated by all the others. A thread is also passed through the centers of membranes, which then serve as supports for long, straight lines. A sort of relay is also formed by means of a brass cylinder with two membranes, to which strings are connected. This method of extending the string telephone has been in use in this country for the past three years.

Communicating with Divers by Telephone.

The telephone has found a valuable application as a means of communication with submarine divers. Signals have hitherto been transmitted by simple pulls on a line, but recently in England the instrument has been connected with divers' helmets. It recently was the means of saving the life of a diver who just before fainting called to be pulled up without making the additional signal with his rope.

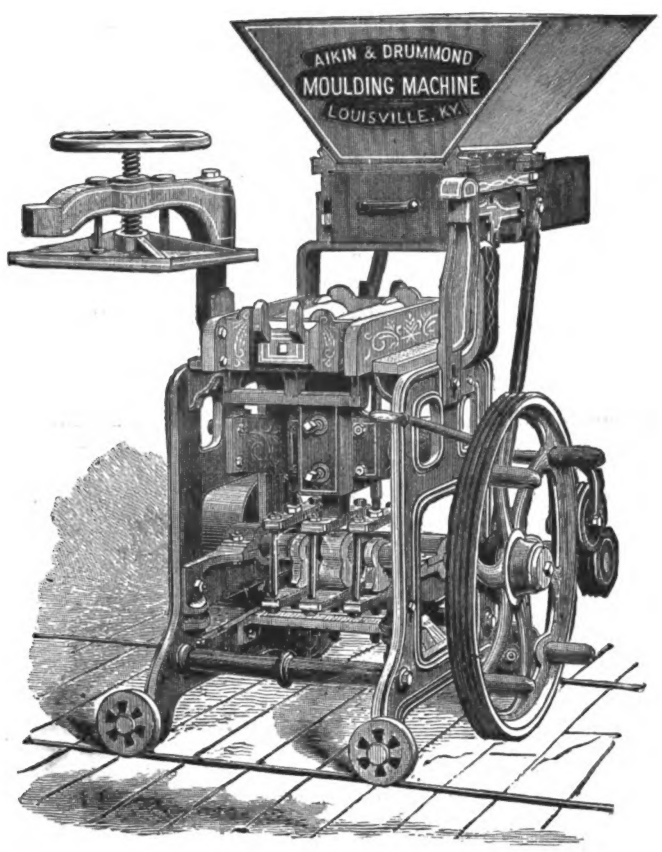
STEAM POWER MOULDING MACHINERY.

We illustrate herewith a new machine for forming moulds in sand for metal castings, the novel features of which are the peculiar movement of the "pattern head and sectional follower," whereby the mould is formed by compression by the simultaneous movement of the two parts, and the withdrawal of the patterns while the moulded sand is held secure by the follower during such withdrawal. The follower then retires, leaving a perfect and complete mould ready for the metal.

The patterns being attached to the movable head and surrounded by a sectional follower, it is claimed to be nearly impossible to make anything but a perfect mould. The result is the producing of a casting an exact duplicate of the pattern, from the fact that there is no rapping of the patterns, no sponging or patching of the moulds required, as is the case in hand or press moulding.

These machines are adapted to make castings for stoves and hollowware, agricultural implements, gearing, pulleys, pumps, axle boxes, malleable iron, and general hardware. They are worked either by hand or steam power. One machine of a moulding capacity of one thousand flasks per day will be exhibited at the Paris Exposition.

For further information address Aikin & Drummond, patentees and sole manufacturers, Louisville, Ky.



STEAM POWER MOULDING MACHINE.

The Steering of Screw Steamers.

At a recent meeting of the Liverpool Engineering Society the results were noted of some experiments recently made on the Clyde to test the steering capacity of screw steamers with the engines suddenly reversed when going full speed ahead, when it was found that the vessel's head turned in the contrary direction to that in which it should theoretically have gone, thus proving that it many cases collisions between two steamers meeting, which might have been avoided, were rendered inevitable by carrying out the Board of Trade directions to port the helm and reverse the engines of both steamers.

The loss of the Guion steamer "Dakotah" was given as an instance of a screw steamer going in a contrary direction to that intended when her engines were reversed and the helm put hard over with the intention of keeping her head off the shore.

Attention was drawn to the advisability of having all screw propellers made either right or left handed, as the divergence in such case would always take place in the same known direction.

Discomforts of the Sick.

Those only who have passed weary days and wakeful nights in weakness and pain on a bed of sickness, with powers of endurance enfeebled, and every form of physical and mental sensibility acutely active, can comprehend the multitude and misery of the discomforts which beset the sick. Noise in its hideously infinite variety; creaking boards, which no deftly-made screw has been devised to secure; rattling china and ware, not yet replaced by ingeniously-devised substitutes—perhaps the old wooden bowl and platter on dumb waiter for food, and articles partially protected with rubber for general use; falling coals and cinders, surely preventable by the employment of wooden tongs and silent ash-pans; harsh door fastenings, possibly avoidable by special apparatus constructed for use with locks temporarily fastened back; glaring lights, that irritate the wakeful, and make the dozing dream and start; puzzling shadows, or lugubrious darkness, evils instantly remediable if only it were possible to secure a soft and shaded light. These are a few of the surface grievances of the first stage of illness, when the head aches, the faculties of hearing and sight are preternaturally intensified, and a morbid fancy extracts suffering and bewilderment from every disturbing circumstance, however small.

Then comes the stage of helplessness, when the sick person lies in the paralyzing grip of his malady, perhaps unconscious or delirious, and those about want all the aids which skill and thought can bring to their assistance to minister to his necessities safely, promptly, and with the least distress or disturbance to the patient and his surroundings. It is seldom possible to say precisely how little or how much the surroundings of a seemingly unconscious person affect him. In this period of an illness, apparatus, contrivances, and arrangements of every class, for the ministration of comforts to the sick, play a not unimportant part in the treatment, and should be so regarded. It is discouraging to observe the meager results of the enterprise bestowed by designers and producers of appliances useful in this phase of sickness. For example, a thoroughly efficient feeder suitable for use in the case of an adult does not exist, and expert nurses revive the old-fashioned butter boat. A shaded hand lamp, of no greater weight than may be borne on a finger, and so contrived that the light will fall at the point required, without assailing the eyes of the patient, is not yet devised. Complicated and costly beds, quite out of the reach of any middle class family, and therefore available only for the wealthy, or the fortunate inmates of hospitals, alone meet the requirement of cleanliness without discomfort. The like is true of nearly all the apparatus for the relief of pain by change of posture, and for securing immunity from pressure, or steadiness in a particular position. The rich and the poor are provided, but not the multitude in narrow circumstances with small and inelastic financial resources.

The stage of convalescence is in many respects the most trying of all. It is then that petty annoyances, such as arise from noises, draughts, smoke, foul vapors, bad or ill managed light, improperly cooked food, nauseous remedies administered in uncleanly and uncomfortable cups or glasses, knives, forks, and spoons that turn over with a clatter, things that fall or are readily knocked down, irritating wall papers, hard, lumpy, or too soft beds, burdensome or cold bedclothes, beds that can only be put in order with labor and confusion. There is scarcely an article or piece of apparatus for the sick chamber which is not obviously susceptible of improvement, and would not repay the thought expended upon it, if placed within reach of families with small incomes, who feel the cost of comfort in sickness. None of these matters are beneath the consideration of the medical practitioner. In no small proportion of cases they are relatively of high moment. It is neither wise nor safe to leave the care of such details to nurses, whether trained or domestic. The physician should be able to direct those in charge of the sick what to provide, where to obtain all necessary appliances, and how to use them when at hand. This is a matter of more than common importance, and it is with the view of reminding the profession and the producers of special apparatus—efficient and inexpensive—of the conspicuous part their enterprise should play in minimizing the discomforts of the sick, we bring the subject under notice.—*Lancet.*

ACCORDING to Dr. Bertherand, there are 166 centenarians in Algeria, thus proportioned: eighty-eight persons are 100 years old, one of 101, seven of 102, nine of 103, fifteen of 104, six of 105, six of 106, five of 107, one of 108, three of 109, eight of 110, two of 111, two of 112, one of 113, two of 114, four of 115, one of 117, and one of 118 years.

New Mechanical Inventions.

A Link and Cross Head of novel construction have been invented by Mr. William Jackson, of Millerstown, Pa. By means of a cord attached to an eye in the upper end of the link the valve reversing mechanism of steam engines may be controlled from a distant point, as the cord may be led any required distance and in any direction by means of pulleys, etc.

Mr. W. E. Stearns, of Rutland, Vt., has invented a Machine for Measuring, Bending, and Cutting Wire, for binding sheet metal vessels of various descriptions. These functions are performed by a combination of rolls for bending the wire, a feeding device for delivering the wire in proper lengths to the bending rolls, a cutter, and a clutch for reversing the action of the machine.

Mr. Neil Malmquist, of New York city, has invented an improved Lift and Force Pump for raising water out of mines, deep wells, and other places where the water is to be conveyed to a great height, and has introduced some novel innovations upon the ordinary systems of construction.

An improved Shingle Cutting Machine, invented by Mr. A. I. Hogan, of Mason, Ill., has a sliding gate, carrying a knife, and a rocking shaft connected with the gate and operated by cams or tappets on the periphery of a horizontal wheel, which is rotated by animal power.

A principal advantage in a new Washing Machine is the fact that it is put together without nails, so that the various parts are not liable to become loose by the rusting off of the nails, and the fabrics not injured by rust stains. This point, with other details, is included in the machine recently patented by Mr. B. F. Comstock, of Lincoln, Ill.

Mr. A. C. Fuller, of Middletown, N. Y., has made certain improvements in Hat Pressing Machines which enable them to be used, with slight modifications, for casting the female die and shell. The base of the press is made hollow and with a close inner wall, to adapt it to serve as a mould, and is heated by means of a steam chest. The pressure is applied by a screw working in upright standards.

An improved Crane, invented by Mr. J. M. de Célis, of New York city, automatically balances the weight hoisted, leaving the crane free from danger of upsetting, and admitting easy swinging upon its pivot. This is accomplished by a lever system connected to the hoisting pulley and chain and to a balancing counterpoise which travels on rails of braced and slightly inclined rear arms. The leverage exercised by the counterpoise is determined automatically by the weight of the load, and the position of the counterpoise also affords a means of measuring the weight hoisted.

Mr. Simon Tragheim, of New York City, has patented a Screw Propeller, which is claimed to admit of almost instant reversing, and at the same time pass through the water with facility. The blades are strengthened by an outer frame extending at both sides obliquely from the hub and across the outer center point of the blade. The front and rear edges of these frames are beveled, so as to cut through the water easily.

Mr. J. S. Schofield, of Little Sioux, Iowa, has invented an improved Saw Mill Head Block and Carriage, in which the carriage is made in two sections, adjustably secured, so that the head blocks are operated simultaneously. The latter carry short beveled and mortised knees, the bevel striking the log directly under the circle and close to the point where it rests upon the blocks, and driving the dog into the log. The details are ingeniously arranged.

A new Car Axle Box, containing an improved device for oiling the journals of the axles of railroad cars, has been patented by Messrs. W. H. and F. C. Burden, of Cleveland, Ohio. The invention consists of the combination, with a journal and oil receptacle in an axle box, of a friction roller or rollers, and an oil guard mounted on sliding bearings supported by springs. The use of cotton waste or similar material is dispensed with, and the escape of oil prevented.

A new Adding Machine, invented by Mr. M. W. Hinkle, of Memphis, Tenn., is formed by the combination of a system of wheels provided with numbered pins and teeth, contained in a small case, and is intended for convenient use in adding columns of figures and keeping the tally of things to be counted.

Soap Bubble Experiments.

M. Remsen, of the Berlin Chemical Society, improves on the ordinary method of igniting soap bubbles filled with hydrogen, or oxygen and hydrogen, as they rise in the air, thus: At a height of 5 or 6 feet above the experimental table is suspended from the roof a large glass funnel in inverted position. A gas burner is fixed in the middle of the lower part of the funnel, so that the flame when formed is in a horizontal plane. It is now only necessary to liberate the soap bubbles somewhere about vertically under the funnel. They come with certainty into contact with the flame. If they contain hydrogen the whole funnel is often filled with the flame, and presents a curious sight.

A PAIR of Siberian hares has arrived at the Jardin d'Acclimatation in Paris. The peculiarity of these animals is that they are gray in summer and white in winter. The French naturalists want to ascertain what effect the temperate climate of France will have on this change of color.

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PLANT MIND.

III.

VOLUNTARY MOTION BY PLANTS.

The *Hedysarum gyrans*, called *Chundali birrum* by the natives, is one of the best specimens of vegetable movement. A particular account of this remarkable plant is to be found in a paper on vegetable motions in the "Histoire de l'Académie des Sciences," by M. Broussonet, Ann. 1784, p. 609. Its leaves are in continual motion; some rising and others falling, and others whirling circularly by twisting their stems, even when the air is quite still and warm. The ten stamens act both as umbrellas and fans to the pistil, and by their perpetual movement seem to be as necessary to the plant as perpetual respiration is to animal life. All sleep is acknowledged to be a suspension of voluntary motion, and the various actions of opening and closing their petals and foliage seem to be the result of a voluntary power or spontaneous movement, and there are many instances of movements of the parts of vegetables to which no epithet is more appropriate than "acts of volition." In the *Marchantia polymorpha*, a yellow wool proceeds from the flower-bearing anthers, moves spontaneously within, and drops its dust-like atoms. The *Collinsonia* has two stamens and one pistil. The stamens are widely divergent, and the pistil bends to one and after a time to the other. It may be that the preference of contact is directed by an unerring instinct to the ripest anther, or the anther whose pollen has first matured.

Another instance of well concerted and voluntary movement is illustrated in the *Gloriosa superba*, with six stamens and one pistil. Three of the stamens mature before the others, and the pistil bends at nearly a right angle so as to insert its stigma among them. As these decline the other three stamens bend over and approach the pistil.

In the *Spartium scoparium*, or common broom, the stamens are in two sets, one rising a quarter of an inch above the other. The lower ones arrive at maturity before the upper ones, but the stigma is produced among the upper or immature stamens; when the pistil bursts open the keel-leaf or hood of the flower, it bends itself round in an instant, and inserts its stigma among the lower or mature stamens. In a few days, the pistil having increased in length, the stigma arrives again among the upper and more recently matured stamens.

In the *Frittillaria persica* the six stamens are of equal length, with the anthers at a distance from the pistil; the first approach to the pistil is made by three alternate stamens or males, the other three make no advances until these decline.

In the *Lithrum salicaria*, a beautiful red flower growing on the banks of rivers, having twelve stamens and only one pistil, six of the stamens mature before the other six, and surround the pistil some time before the other six rise up to supply their places. The *Adoxa*, *Lychnis*, *Saxifraga*, and several others have two sets of stamens of different ages. Ten stamens in the *Kalmia* are placed around the pistil like the radii of a wheel, with each anther concealed in a niche of the corol, being thus protected from excessive cold or moisture; these anthers rise separately from their niches, approach the pistil for a time, and then recede to their former situations. The *Amaryllis formosissima* affords another beautiful example of that operation of the living principle residing in plants, and cognizable only in its effects. The pistil is of much greater length than the stamens. To counteract this apparent disadvantage both pistil and stamens decline downward, thus giving the fructifying pollen an opportunity of falling upon the stigma. To secure this effect the corolla is lacerated, and the lowest division, with the two next lowest ones, are closely wrapped about the style and filaments, binding them down, and much lower to the horizon than usual in other flowers of this genus.

Another instance of an exertion of the sensorium, or spirit of animation in plants, may be found in the *Hemerocallis flava*, where the long pistil is often bent somewhat like the capital letter *N*, with design to shorten it, and thus bringing the stigma among the anthers, that it may receive the fertilizing pollen powder.

Voluntary movement in plants is by no means confined to the purposes of reproduction, but purposes of concealment, protection, and preservation are frequently manifested; as, for instance, in the *Dodecatheon* of Linnæus, *Meadia*, or American cowslip, the pistil is much longer than the stamens, and the bend of the flower stalks enables the stigma to receive the fecundating dust of the anthers. The petals are turned back to prevent rain or dew from washing off this dust prematurely, at the same time exposing it to light and air. When the seeds are formed the flower stalks are erected, and thus the seeds are kept from falling out. Indeed the conservation of offspring is one great end, never overlooked in this wonderful department of animated nature.

Finally, we instance the *Cyclamen*, or shewbread. When the seeds are ripe the stalk of the flower gradually twists itself spirally downward until it touches the ground, and, forcibly penetrating the earth, lodges its seeds, where they receive nutriment from the parent root, for they are not found to thrive in any other situation. The subterraneous trefoil, *Trifolium subterraneum*, also buries its seeds; and there is another, *Trifolium globosum*, which has a curious mode of concealing its seeds. The lower florets only are fertile and have corols; the upper florets wither into a kind of wool, which, forming a head, completely conceals the fertile calyxes.

Animals are supposed to possess higher animation and greater sensibility than plants, but plant sensibility can be proved to be quite as exquisite and the animation as ceaseless in its operation, if only studied with care and diligence, and our coarser vision aided by the new forms of construction which are daily increasing the value of microscopic investigation, and revealing more and more facts relative to animating forces in the wide domain of the vegetable world.

R. C. K.

GLORIOSA SUPERBA.

HEDYSARUM GYRANS.

MEADIA.

AMARYLLIS FORMOSISSIMA.

Quite to be Expected.

A boiler explosion recently occurred on board the Hudson river steamboat Magenta, whereby four persons were killed and several severely injured. Investigation has shown that an excessive steam pressure was being carried in a boiler badly corroded, the iron being in some places barely as thick as a knife blade. The generator was last inspected in June, 1877. One severe example made of the owners of a boiler of this kind would do more to stop boiler explosions than any number of fine spun theories on the occult causes of such disasters. Boilers in the vast majority of cases explode because they are too weak to stand the pressure they carry, and for that some one ought to be always rigidly held responsible.

New Inventions.

Mr. R. B. Sanderson, of Bridgewater, Pa., has patented a handy combination of Hanging Shelves, in which the shelves are supported by brackets adjustably secured to slotted hangers by clamp screws, so that the shelves may be arranged at any desired interval. The upright hangers are provided with pronged hooks at the top, by which the apparatus may be conveniently suspended from crossbars, staples, window casings, etc.

An improved Rocking Chair, of that class in which the seat swings by curved rockers on straight rails of a base frame, has been patented by Mr. George Roeder, of New York city. The arrangement of the springs and stop devices is simple and original.

A non-poisonous Sheep Wash, composed of specified proportions of tobacco, potash, turpentine and tar, diluted with water, has been patented by Messrs. A. and R. Scott and C. A. Skene, of Wamego, Tex.

Mr. Jessup Whitehead, of Central City, Col., has patented a Pastry Table, which, by the use of cold water and ice, serves for making and keeping confectioners' puff paste, and which may be used with hot water for raising dough. The table is hollow, with hollow side and rear walls, and has below it hollow shelves inclosed by a cupboard having marble or metallic sides. Hot or cold water is introduced, as desired, by pipe connections.

An improved Tool Handle, invented by Mr. J. E. Parrish, of Centerville, La., is provided with a rubber tip, suitably secured, to prevent battering when a mallet is used.

Mr. J. B. Harrison, of Cincinnati, Ohio, has invented an improved Ash Pan for Locomotives, intended to provide a convenient means for dumping the cinders and ashes, to facilitate cleaning the fire, to prevent choking of the draught, and burning of the grate bars, and to admit of instantaneous extinction of the fire when the pumps fail to work and the water in the boiler gets too low. The bottom of the pan is a series of slats pivoted at their ends and connected together, to be operated for closing and opening by a rod, like window blinds, and surrounded by a perforated water pipe for cooling the ashes before emptying and extinguishing the fire when the coals are dropped from the fire grate.

Mr. Luther Read, of New York city, has designed a Centerboard for Vessels, which is constructed with the object of preventing jamming when the board strikes bottom. The board is pivoted in the case at its forward lower end, and is raised by a chain attached to a lever and shackle behind a projection upon its lower rear corner. The chain runs over a sheave in the lower part of the case, so as to give it a direct draught, and is kept out of the way of the board by a separating partition.

Mr. Henry Groth, of New York city, has invented an ingenious Toy Carriage, which is so constructed that the uncoiling of the driving spring rewinds the cord by which the mechanism is wound up, ready to be again operated.

An improved Match Safe, the invention of Mr. G. R. Taylor, of Cranston, R. I., is arranged so as to ignite the match as it is forced out of the safe. One side of the box is made sufficiently thin to admit only one match at a time, and a follower drives this match out, a serrated spring in the cover igniting the latter as it emerges.

Mr. A. F. Pfeifer, of Newark, N. J., has patented an improved device for Adjusting Transoms, in which a hand rod, which may be locked by side pins into a recessed guide socket, operates a system of lever mechanism in an original manner.

Mr. Edward Hagerty, of New York city, has invented an improved metallic Cap for Glass Syringes, which is spirally threaded so as to be screwed into a cork, has a guide tube for the piston rod, and is provided with overlapping flanges which protect the edges of the glass barrel.

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A device for Twisting Yarn into Hanks has been patented by Messrs. B. S. and A. Jennings, of Sullivan, Ill. The twisting rod, which is contained in a box, has a hook for the hank at one end, and is attached at the other end to a weighted cord. As it is drawn through the box it is caused to rotate by means of a fixed spiral guide, and the number of rotations is regulated by an adjustable stop pin.

A new Brake for light vehicles, invented by Mr. C. H. Weiss, of Eckley, Pa., consists of a friction strap surrounding the inside hub band, and prevented from turning by an arm attached to the axle. It is operated by a lever, which draws the ends of the strap together so as to clamp the hub band.

A folding and otherwise adjustable Ironing Table has been devised by Mr. M. S. Prescott, of Otisville, Mich. It is strongly braced, and furnishes a support for large articles which would otherwise touch the floor.

Mr. J. M. Castillo, of New York city, has invented a convenient Hat Hanger, designed for suspending a hat from the back of an opera chair, or in similar positions. It may be folded into small compass and carried in the pocket.

An improvement in Wagon Box Fastenings has been made by Mr. C. G. Conkling, of Hopewell, Pa. The object is to furnish a means of quickly taking apart or putting together the sides, bottom, and ends of a wagon body, so that it may readily be adapted to the nature of the material to be carried, and the invention consists in hinging straps or stirrups to the bottom bars, and locking them by eccentric levers carried by the side boards.

An improved mode of Securing Vehicle Wheels to their Axles has been patented by Mr. F. C. Lee, of Ridgefield, Conn. The outer end of the hub is closed, and upon its inner cylindrical end a ring groove is formed, in which fit adjustable keys carried by projections of the axle and held in place by an annular open spring band. The hub can be readily released by springing the band open, when it is desired to oil the bearings, or for other purposes.

SOME SEASONABLE HINTS ON PLANT CULTIVATION.

In order to obtain good plants, especially those for the vegetable garden, it is absolutely essential to raise them from seed, for those offered for sale in the markets are grown for sale and are neither healthy nor robust. If, however, there are no facilities for seed propagation and the purchase of plants becomes unavoidable, the following instructions will be found valuable:

THE SHAPE OF GOOD PLANTS.

Select those that have short, robust stems, for a long or slender stem indicates that the plants have been rapidly forced by artificial heat, or were grown too close together, in which case the sides and undergrowth have been excluded from the light and air, and the plants have, as it were, stretched their necks in their efforts to reach the light. If a plant has a small amount of root in proportion to the foliage it is weakly from having been forced too quickly or under too great a heat. The more root, the stronger and the greater the growing capacity of the plant. If the leaves are of a yellow cast it may occur from an unhealthy condition caused, in all probability, from having been but recently taken from the hotbed or forcing house, from having been taken from the plant bed too long, and, in some cases, from there being insects or grubs at the roots. If the roots are very short it shows that they have been carelessly taken from the beds and the rootlets have been broken off. A short or stubby root is always detrimental to the plant, while if the root is long and fibrous it is of little consequence if the foliage is small or short, providing that it has a deep green, vigorous appearance.

HOW TO PLANT THE SEED.

The beds to receive seed should be composed of a light, loamy or peaty soil, prepared when comparatively dry, and finely pulverized. The bed should be raked level and smooth, the seed being sown not too thickly and covered to a shallow depth. Large sized seeds should have nearly half a inch of covering, while fine seeds require an eighth of an inch only, and very fine ones still less. The soil should be flattened about them sufficiently to close the earth without making it very compact, and the bed should be lightly watered immediately after the seeds are planted.

WATERING THE SEED.

A common error is the giving of water in too great a quantity, and in too large drops. The soil requires to be kept moist but not wet, or the seeds are apt to rot. It must be remembered that the seed has to force its way through the soil, and that the latter will readily give way to the pressure when moist, but not when caked hard and dry. A little water often applied through a fine rose spout or sprinkler is the most advantageous.

THE TEMPERATURE.

If the temperature is too great the seed will propagate quickly and shoot up, in a spindling condition, above the surface of the soil. The stems will appear whitish and partly transparent; the growth of the foliage will be excessive in proportion to that of the root; the plants will be weak and comparatively valueless. If kept too cold they will appear yellowish and stunted, many will die, and the remainder will become old without attaining vigor. The best temperature ranges between 45° and 50° Fah., and in order to maintain this as near as possible the plants should be watered, at this time of the year, in the morning. The plants should not be placed in a position in which the light comes in from one side only, or they will stretch themselves in that direction.

TRANSPLANTING.

The object of transplanting is to check the growth of the foliage and promote that of the root, and this is best done while the plants are young, so that, when they are finally planted out, there will be sufficient root to support a vigorous upper growth. As soon as the plants are well above the surface of the soil they should be thinned out; that is, the weaker ones should be removed, so that those left may have free access to the air and not be crowded. In thinning out, leave the shortest and strongest plants, keeping them as nearly as possible an equal distance apart and with a small space between the leaves of one plant and those of the next. As soon as the plants have six visible leaves the first transplating (called the pricking out) should be performed. First the seed bed should be watered, and about an hour afterwards the plants should be removed to another bed, prepared of rich, light soil. In removing the plants from the old bed it is of great consequence to preserve the rootlets, and to this end a three or four pronged fork should be employed, lifting the plants gently and handling them carefully, planting them nearly up to the leaves in the new bed, placing them three or four inches apart, and pressing the earth very lightly about them, and finally lightly sprinkling them with water. The bed in which they are transplanted should be prepared rather dry, and if out of doors just before a shower of rain is the best time. Plants that have been thus transplanted not only grow to greater perfection, but are more hardy and will stand a protracted drought much better.

SELECTING DOUBLE SEED FROM SINGLE PLANTS.

Not many florists even are aware of the manner of selecting from plants having single flowers seed that will produce plants having double flowers. If we closely examine the bloom upon single wall flowers or single stocks we shall find here and there a bloom that has one more leaf in it than the ordinary bloom, and the presence of this extra leaf is an infallible sign that the seed produced from that bloom will produce a plant bearing double blooms. To mark the seed a short piece of scarlet silk is loosely tied upon the stem of the extra leaved flowers, or where the different plants have differed colored blossoms the color of the silk may denote the color of the flower also.

The Northeast Passage.

After the lapse of more than two centuries the discovery of a northeast passage from Europe to China is again about to be attempted, this time by Sweden, and though in the present state of geographical knowledge no one now expects to find a trade route to the East, still an undertaking of this nature is sure to excite a lively interest among seafaring nations, and more especially in England, the country which first sought to solve the problem. Professor Nordenskjold, a well known Arctic explorer, to whom the suggestion and scheme of the intended exhibition are due, has already, in 1875 and again in 1876, passed east of Novya Zemlya to the further shore of the Kara Sea, where close to the eighty-first parallel of east longitude, and to a headland marked Effremoffstone Point on the English Admiralty chart, he found a good anchorage, and named it Deckson's Haven. This harbor lies considerably to the eastward of the furthest point previously reached by English or Dutch navigators, but as it is in Professor Nordenskjold's opinion easily attainable before the end of August, in ordinary seasons, it ought, he thinks, to be regarded as a fresh point of departure for any future voyage of discovery; and, therefore, in reporting on the results achieved by former expeditions, he had confined his attention to those whose work lay east of the river Yenesei. Of expeditions from Western Siberia the first descended the Yenesei in a small vessel transported from Tobolsk. In 1738 and the following year the expedition stopped short while yet in the estuary of the river, and in 1740, when at last it passed fairly outside the Yenesei, its leader did not venture further north than latitude 75° 15′, but on September 2 thought it prudent to turn back and seek winter quarters. In 1842, after an interval of more than a hundred years, a Russian named Tjeluschin, in command of a sledge party, followed the west coast of Taimoor peninsula until, in latitude 77° 34″, he reached Cape Northeast, or, as it is sometimes called, Cape Tjeluschin, the extreme point of the Asiatic mainland in that direction. In May, the date of Tjeluschin's discovery, the sea, as might be expected, was completely frozen, but in the following year, when Nuddendorf, traveling overland, arrived on August 25 at Taimoor Bay, in latitude 75° 40′, he could see nothing but open water to the northward, and reported upon the authority of one Fonim, said to have spent a winter there, that the ice breaks up in the first half of August, and is then, under the influence of prevailing winds, driven so far from the shore that it becomes barely visible from the high ground.

Between Cape Northeast and the mouth of the River Lena our knowledge of the coast is derived from the reports of Russian surveying expeditions sent out from Yakutsk. In 1735 Proutschischeff, a lieutenant in the Russian navy, starting from that town, descended the Lena for more than 800 miles, passed out to sea by its eastern mouth, and, after sailing westward round the delta, wintered in Olensk Bay, in latitude 72° 54′. Next year, on August 5, when the ice broke up, he started afresh, and continued his voyage until September 1, when in latitude 77° 29′, quite close to Cape Northeast, he met ice, and turned back. In 1739 another expedition, under the command of Lieutenant Laptew, also of the Russian navy, left the Lena on August 1, and on September 2 was turned back by ice at Cape Thaddeus, some fifty miles from Cape Northeast.

East of the Lena, where the coast trends gradually to the southward, there is evidence of a regular coasting traffic carried on in the sixteenth century between the mouths of the different rivers, and between the mainland and the Liskov islands. Of the voyages made at this early period little is now known. There is, however, a map dated St. Petersburg, 1758, on which the route is marked as *anciennement fort frequentée*, and we have also the record of some legal proceedings arising out of a dispute as to the discovery of a walrus bank on the east coast of Kamtchatka. Thus we learn that of seven small vessels which left the river Kolyma on July 1, 1648, one, that commanded by a Cossack named Deschnew, passed through the straits since called after Behring, and in October arrived at Anadyr. Again, between 1735–40, Russian explorers attempted to find their way from the Lena eastwards, and though none of them reached Behring Straits they followed the coast as far as Cape Baranown, east of the river Kolyma.

Of attempts to sail westward from Behring Straits the most successful was that of the American expedition of 1855, under the command of Captain Rodgers, which reached the 170th parallel of east longitude, while Cook in 1778 stopped short at the 180th, and Behring in 1729 got no further than the 172d parallel of west longitude.

The Russian adventurers who bit by bit surveyed so great a length of unknown coast line had at their disposal none but country craft, dependent upon oars or a leading wind, and equally unable to live in a seaway or to resist the slightest pressure by ice. Moreover, as such vessels could afford their crews no sufficient shelter from the rigor of an Arctic winter their commanders were greatly hampered by the necessity under which they lay of securing a return to the nearest settlement before navigation should become impeded; the further, therefore, they advanced from home, the earlier they had to begin their retreat, and thus they seem to have always relinquished their object at the very beginning of September, just as the time was approaching when, as we have since learned, those seas are least encumbered by ice. Professor Nordenskjold, therefore, while he acknowledged the courage and hardihood of the crews, and the tenacity of purpose displayed by their leaders, thinks nevertheless that their sufferings and frequent failure ought not to discourage Swedish sailors serving on board a roomy steamship, properly strengthened for Arctic work, and fully supplied with provisions and other necessaries, in case she should be compelled to winter in the ice.

Out of a fund raised by private subscription Professor Nordenskjold has purchased the steamship Vega, and proposes, in a petition for assistance from the Swedish Admiralty, lately presented to the King, that, after being fitted out and supplied with coals and provisions at the expense of the government, she should be manned by volunteers from the navy under the command of their own officers. Besides her crew of 19 men and officers, it is intended that she should carry a surgeon, and by way of scientific staff Professor Nordenskjold and three assistants. Leaving Gothenburg in July, she will call at a port in the north of Norway to ship four harpooners and to fill up with coal, and will thence sail direct for Deckson's Haven, where she is expected to arrive before the end of August.

The immense body of warmer water from lower latitudes poured into the Kara Sea by the Obi and the Yenesei forms a strong current which, according to Professor Nordenskjold, is, off their mouths, deflected by the diurnal rotation of the earth and made to flow along the coast in a northeasterly direction. Starting from Deckson's Haven in September, when this warm current has had time to exercise its full effect upon the coast ice, Professor Nordenskjold hopes to find, at all events, a lane of open water which will enable him to double Cape Northeast, and should he succeed in doing so without any great delay, he thinks that the expedition may reach Behring Straits before the end of the season. Should it prove impossible to pass round Cape Northeast until very late in autumn, or should the distance thence to Behring Straits render such a step necessary, the expedition, by wintering near the mouth of one of the larger rivers, would probably find some opportunity of communicating with home overland, and the ship would be in a position to complete her voyage in the course of the following summer, and return home by way of the Suez Canal.

Among the advantages which it is hoped may be derived from the proposed expedition, Professor Nordenskjold, after referring to the happy results of fostering a spirit of enterprise in the English navy, lays especial weight upon the value of the observations which the scientific staff will be in a position to make, and points out the great benefit which will be secured to Siberia, and in a scarcely less degree to the world at large, should it prove possible, as in the case of the North Atlantic and the Yenesei, to discover a practicable summer route from the Pacific by way of Behring Straits to the Lena, one of the great navigable rivers which afford the chief means of internal communication throughout the vast extent of Central Asia.

THREE remarkable steps in scientific progress and discovery have been made within the past few months: The reduction of the telephone to practical use on telegraph lines; the discovery of the phonograph, by which the sounds of the human voice are mechanically recorded and redelivered; the liquefaction of hydrogen and oxygen gases by pressure and cold.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line.

Mechanical Working Drawings a Specialty. Pemberton & Scott, Draughtsmen, 37 Park Row, room 30.

Portable and Stationary Engines; Boilers of all kinds; 45 Cortlandt St., N. Y. Erie City Iron Works, Erie, Pa.

Air Compressors, Steam Pumps. James Clayton, Brooklyn, N. Y.

Alcott's Turbine received the Centennial Medal.

Vertical Scientific Grain Mills. A.W.Straub & Co.,Phila.

Warranted best Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

24 inch Second-hand Planer, and 12 inch Jointer, or Buzz Planer, both in first-class order, for sale by Bentel, Margedant & Co., Hamilton, Ohio.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester,N.H.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

Agents wanted in every county to sell our new Machine to File all kinds of Saws. Every one that uses a Saw will buy one. Price $2.50. Illustrated Circulars, etc., free. E. Roth & Bro., New Oxford, Pa.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

For the best Bone Mill and Mineral Crushing Machines—five sizes, great variety of work—address Baugh & Sons, Philadelphia, Pa.

Galvanized Iron Cornice Machines.—The most Improved, Straight and Circular. Prices reduced. Calvin Carr, Cleveland, O., & Hewes Machine Wks.,Newark,N.J.

Wanted.—2 H. P. Air or Spring Motor, weight 200 lbs., or less. J. M. Lauck, Parkersburg, W. Va.

For Sale.—Brown & Sharpe Universal Milling Machine; 5 ft. Iron Planer, 24 in.square; two 18 in., 44 in. bed Power Lathes. W. E. Lewis, Cleveland, O.

Carriage Axles, Springs, Bolts. Wanted full particulars and prices of machines used in the manufacture of above. Address Selby & Co., Longmore St., Birmingham, England.

Lot of Second-hand Machinery for sale. G. Place Machinery Agency, 121 Chambers St., New York.

For Sale.—A rare opportunity to secure Shop or State Rights, or the entire patent, for the best Balance Valve, with automatical cut-off regulator for portable and stationary engines; no experiment; hundreds of them in use giving good satisfaction. H., Carrier No. 4, Detroit, Mich.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use proves them stronger and more durable than wrought iron. See advertisement, page 238.

Lansdell & Leng's Lever and Cam Gate Valves. Cheapest and best. Leng & Ogden, 212 Pearl St., N.Y.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Cornice Brakes. J.M. Robinson & Co., Cincinnati,O.

Walrath's Improved Portable Engines best in market; 3 to 8 H. P. Peter Walrath, Chittenango, N. Y.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Blake's Belt Studs, best fastening for Rubber and Leather Belts. Greene, Tweed & Co., 18 Park Place, N.Y.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor, and Upright Mill Spindles, which can be stopped instantly; Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Ct.

Union Eyelet Company, Providence, R. I., Manufacturers of Patented Novelties on royalty.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

Boilers & Engines cheap. Lovegrove & Co., Phila.,Pa.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Horizontal Engine, 16 x 36, built by the Fishkill Landing Company, for sale cheap. G. Place Machinery Agency, 121 Chambers St., New York.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

For Power&Economy,Alcott's Turbine,Mt.Holly,N.J.

Safety Linen Hose. Suction and Rubber Hose of all kinds. Greene, Tweed & Co., 18 Park Place, N. Y.

NEW BOOKS AND PUBLICATIONS.

QUARTERLY JOURNAL OF INEBRIETY. Published under the auspices of the American Association for the Cure of Inebriates. Hartford, Conn.

The March number of this valuable periodical contains much interesting matter, including papers on "The Influence of Alcohol on Mental Maladies," by M. Magnan; "Inebriate Asylums," by Dr. N. S. Davis; "Curability of Inebriety," by Dr. Albert Day; and a variety of original and selected articles. The prevailing tone of the *Journal* is liberal, and is in pleasing contrast to the unfortunately too common failing of many temperance advocates, who are apt to be led, through excess of zeal, into being intemperate in language if in nothing else. For instance, we find Dr. Day saying: "No doubt that wine—the natural product of the vine—was intended as food for its exhilarating, cheering qualities, and not as an intoxicant;" and elsewhere in the present number similar expressions occur, evidencing an enlightened view of a subject rarely discussed with entire fairness.

REPORTS OF JUDGES OF GROUPS 4, 9, 12, 15 and 17, Centennial Exhibition. J. B. Lippincott & Co., Philadelphia.

These reports, edited by Mr. Francis A. Walker, Chief of the Bureau of Awards, consist largely of lists of prizes awarded and the reasons therefor, but are prefaced with general comments on the several groups of exhibits which furnish much valuable information. Group 4 includes animal and vegetable products and the machinery for their preparation, and its importance warrants the minuteness with which the reports have been drawn out; group 9 consists of wool and silk fabrics, materials and machinery; group 12, leather and its manufactures; group 15, builders' hardware, edge tools, cutlery, etc.; and group 17, carriages, vehicles, etc., and their accessories.

SECOND ANNUAL REPORT OF THE NEW YORK STATE SURVEY. 1878.

We are indebted to Mr. James T. Gardner, Director of the Survey, for a copy of this report, which gives particulars of the work accomplished during the year 1877. The triangulation now extends across eleven important counties in the heart of the State, and has afforded the means of determining with great accuracy nearly 170 geographical points lying within an area of 3,000 square miles, and forming parts of these counties. The expenses during the year were $13,977 41, leaving an available balance of $2,406 36.

MATTER AND MOTION. By J. Clerk Maxwell, F.R.S. D. Van Nostrand, publisher, New York. Price 50 cents.

This little volume is No. 36 of the Science Series, and is not inferior in point of interest to its predecessors. Mr. Maxwell has succeeded in compressing a very thorough *résumé* of his subject into a compact and serviceable shape—a task which, considering the temptations toward diffuseness, is by no means a light one.

The March number of *Industrial Art* contains the usual variety of readable articles, and is profusely illustrated. The leading topics are Art Education, Ancient Textile Art, Technical Education on the Continent, Fresco Painting and Modern Mosaics, and Notes on the Paris Exhibition of 1878. This excellent publication fills an important niche in serial literature, is ably conducted, and presents a handsome typographical appearance.

Notes & Queries

F. E. B.—See answer No. 43, p. 188, SCIENTIFIC AMERICAN, current volume.—J. Y. L.—See SCIENTIFIC AMERICAN, June 30, 1877, p. 408.—E. B. C.—The inductive effect in the arrangement you describe would be only momentary, and under the conditions would hardly be appreciable.—A. L. B.—See p. 155, SCIENTIFIC AMERICAN of March 9, 1878, No. 19.—J. F.—Use the cement recommended F. G. R., this page. Melted rubber sticks well enough, but does not readily harden.—W. H. B.—It should read —65° C.—L.V.B.P.—See answer No. 34, SCIENTIFIC AMERICAN, November 10, 1877, p. 299.—A. L. B.—Consult "Chemical Recreations," by J. J. Griffin, F.C.S., London.—G. J.—Ether is not injurious to iron and steel.—W. M. S.—See SCIENTIFIC AMERICAN, January 23, 1875, p. 49; also, March 27, 1875, p. 193; January 4, p. 20.—F. A.—The solution is camphor and sal ammoniac in alcohol, and fails to give satisfactory results.—J. H. H.—We do not know of such a process.—C. N. V.—We think the plan you describe will answer.—S. C. T.—There are a number of materials for the purpose in the market. If you do not find addresses in our advertising columns, you might obtain them by inserting a notice under head of "Business and Personal."—E. B.—We think you will have no difficulty in using coal stoves as you suggest, if your chimney is of sufficient height and clean, with a separate flue for each stovepipe.—W. C.—Among the most important studies for a machinist may be mentioned arithmetic, algebra, geometry, trigonometry, elementary mechanics, drawing, and the laws of heat, steam, and combustion.—T. G.—It is generally more economical to run an engine fast, and as there would be no practical difficulty in your case, it might be better to use the short stroke cylinder. As to pressure required, see SCIENTIFIC AMERICAN for July 17, 1875.—T. & A. W.—The data sent are not sufficient for us to judge of the practicability of the scheme. It will be well to refer the matter to an engineer.—J. C. H.—We think you can use a cylinder 3 x 6 if it is convenient to increase the stroke.—W. H. A.—There are several varieties of the instrument you refer to in the market. It is commonly known as an ear trumpet.—A. J. and M. E. P.—See answer No. 17, SCIENTIFIC AMERICAN of March 4, 1876.—R. R. J.—We can imagine circumstances under which the flanges would probably break, but we do not think they would be certain to do so in ordinary use.—J. G.—In the query referred to, we understood that reference was made to stationary boilers of the two styles known as locomotive and return tubular, and our answer was based on the results of experiments.—S. E. W.—Your data are insufficient, but, as we understand you, there is probably no great difference between the two.—J. W. L.—A 2 x 5 inch cylinder will, we think, be sufficient for the work you describe.—H. L. C.—We do not understand, from your question, exactly how the device is to be used. Send a sketch and full description.—A. B. E.—You might use a small hot air engine, which would not occupy much space and could be placed in any convenient location.—J. V. A.—If you mean a permanent magnet, 12 inches would be a good length for the diameter mentioned.—C. C.—Fryer's work on "Constructions in Iron" will probably assist you.—W. T. B.—See "Science Record" for 1874, p. 98; also, Watt's "Dictionary of Chemistry," with supplements.—A. M. D.—See SCIENTIFIC AMERICAN, vol. 34, p. 386.—J. A. J.—We do not know of such an explosive as "liquid dynamite." Probably nitro-glycerin, which sometimes exudes from dynamite when carelessly made, is what is meant.—W. H. C.—If you run the engine at a high speed, it would probably increase the power to make the alterations you propose. The covering mentioned usually prevents some loss of heat, and under some circumstances helps to preserve the iron.—L. B. H.—See answer No. 62, p. 156, SCIENTIFIC AMERICAN, September 8, 1877; and answer No. 10, p. 314, May 15, 1875.—E. C.—Brass can be cast in any iron mould that is properly vented to allow the air and gases to escape. The other materials you suggest would not be so durable. Diagram not received.—G. S.—About two horse power will be sufficient.—D. D. B.—There are such saw-filing machines in the market. Consult advertising columns or insert a notice under "Business and Personal." Emery wheels are made as thin as ⅛ inch. The saws are cut by punching machines.—C. F.—As we understand the arrangement, we think it will answer.—L. S., J. B., and J. W. Z.—Insert notice in "Business and Personal" column.

(1) M. S. asks: What is it in ginger beer that makes the corks start out when the wires are taken off, and causes the beer to foam? A. The liquid is surcharged with carbonic acid (gas).

(2) J. B. C. asks: How can the capacity of a coal bin of given dimensions be found? A. If it is rectangular, take the product of the three dimensions in feet, and allow about 40 to 45 cubic feet for each ton of coal. If the bin is not rectangular, no general rule can be given without knowing the form, but you will find rules for special cases in works on mensuration.

(3) J. G. R. asks: What pressure will a boiler 18 inches high and 9 inches in diameter, made of 20 ounce copper, safely stand? A. From 15 to 20 lbs. per square inch. In reference to your second question, address the manufacturers.

(4) W. D. P. writes: O. C. L. can kill the vermin on his cattle with a decoction made from tobacco stems or other cheap tobacco. An application of coal oil put on very thin, or weakened, will answer; a strong application is not good for the animal.

W. D. P. will find a recipe for bluing gun barrels in SCIENTIFIC AMERICAN, July 21, 1877, p. 44 (46).

(5) F. G. asks: 1. Is too much blast in a melting furnace injurious to the iron? What effect does it have upon the iron? A. The principal effect of too much blast is to waste fuel. 2. How much pressure of blast per square inch should we have for a 28 inch cupola melting 8,000 lbs. per day with best anthracite coal? A. Exactly what pressure is best, under given conditions, should be settled, as it readily can be, by a few experiments. 3. Does poor coal affect the strength of iron? A. Coal containing ingredients that are injurious to iron is apt to affect its strength.

(6) G. M. A. writes: Tyndall in his "Fragments of Science," p. 19, uses the following words referring to a brick thrown into the air: "If not here caught by the bricklayer, it would return to the hodman with an accelerated motion, and reach his hand with the precise velocity it possessed on quitting it." My preconceived ideas were in accord with Tyndall, and I was surprised when I read your reply to C. H., p. 108, current volume. Would it be asking too much to set forth your reasons for saying that a bullet fired upward from a gun will not return to the earth with the same velocity with which it ascended? A. The resistance of the air affects the velocity. In a vacuum, the initial and final velocities would be the same. You will find an interesting investigation relating to this question in Bartlett's "Analytical Mechanics.

(7) F. G. R. asks: How can I cement firmly small pieces of soft India rubber to brass? A. Try a fused mixture of about equal parts of gutta percha and genuine asphaltum.

(8) H. B. M. asks: What was the best time made by the steamboats Chauncey Vibbard and Mary Powell? A. The Vibbard is reported to have made the run from New York to Albany, in 1876, in 6½ hours. The Mary Powell made the 76 miles between New York and Poughkeepsie in 3h. 3m., and it is claimed that on August 7, 1874, she ran from her dock to Piermont, 28 miles, in one hour. It is difficult to obtain trustworthy records.

(9) J. W. Y. wishes to know the mode of applying a waxed oil finish to black walnut furniture. A. Rub on a mixture of linseed oil and yellow wax, which may be colored by alkanet root.

(10) F. L. S. writes: I have a speculum of three parts copper to one part tin. How can I polish it? A. If it is scratched, you may first use very fine emery cloth, and then finish with rottenstone and oil.

(11) X. Y. Z. asks: What is the cause of sparks flying about more at one time than at another when they are casting in a blast furnace? A. It may be due either to differences in the iron or moulds, or mode of handling.

What should be done to cure eruptions on the face? A. It is advisable to purify the system.

(12) C. W. B. writes: I am building a high pressure condensing engine, cylinder 7 inches diameter, 9 in. stroke, 180 revolutions per minute. Average pressure 80 lbs. It is for a steam yacht. 1. How many square feet of cooling surface do I require (surface condenser), water to be taken from outside? A. Allow ¼ square foot of cooling surface for each pound of steam condensed per hour. 2. What should be the capacity of the cold water pump, making 180 strokes per minute? A. Make it large enough to supply from 35 to 40 times the weight of steam condensed. 3. What should be the area of steam ports for a cylinder 7 x 9? A. At least $\frac{1}{10}$ of piston area.

(13) J. M. H. asks: 1. What is the meaning of the word "line" as applied to the measurement of watches? A. A line is $\frac{1}{12}$ of an inch. 2. What is meant by the word "plate?" They are said to be full plate, three quarter plate, etc., as applied to the movements. A. In the full plate watch the balance wheel is above the plate; in the three quarter plate, below. 3. Has a watch ever been invented to run by atmospheric pressure or compressed air? Would such an escapement be practicable? A. We never heard of such an escapement, but are not prepared to say that it is impracticable. Compressed air has been tried for clocks.

(14) F. T. C. asks: Why is a tidal wave formed on the side of the earth opposite to that directly under the moon? A. Brande makes the following statement: "The attractive force of a body on a distant particle of matter varying inversely as the square of the distance, the particles of the earth on the side next the moon will be attracted with a greater, and those on the opposite side with a smaller, force than those which are situated intermediately. The gravitation towards the earth's center of the particles nearest the moon will therefore be diminished, and, consequently, if at liberty to move among themselves, they will rise above the general level. In like manner, the moon's attraction on the most distant particles being less than on the central ones, their relative gravitation towards the center will also be diminished, and the waters will consequently be heaped up on the side of the earth which is turned away from the moon."

(15) A. C. F. asks: What is the safe working pressure of a boiler shell 44 inches in diameter, ¼ inch good boiler plate? A boiler maker says it is safe at 150 lbs. to the square inch. A. We think 60 lbs. would be a much safer figure.

(16) H. & S. write: We have a 12 x 20 cylinder that now takes steam to within 2 inches of the last part of stroke. Can we by lengthening the valve so as to cut off at one half or two thirds the stroke get one half or two thirds the same power, which is all we need? A. We think your best plan will be to change the point of cut-off as suggested. If you can also increase the speed of the engine, you may effect some saving.

(17) C. S. I. asks: 1. What effect does it have on a slide valve to diminish or increase the size of the openings under it, the valve to remain the same size in both cases? A. If that is the only change the general effect would be to cause a very unfavorable distribution of steam. The question is so general that no very definite answer can be given, but you can make a model out of cardboard or stiff paper, and determine the action in any given case very readily. 2. Suppose there were no openings under the valve, what would be the pressure on it? A. The projected area of the valve, multiplied by the steam pressure, if it is supposed that the valve is tight.

(18) C. H. L. asks: 1. What is the best solvent for asbestos? A. There is no solvent for asbestos as such. 2. Can asbestos be reduced to a powder, so as to be mixed with other ingredients? A. Yes; heat it strongly and quench in cold water; then grind to powder.

(19) B. H. W. writes: I have a telegraph line 1 1-3 miles long in excellent working order. The wire is No. 12 galvanized, and is worked with 9 cells gravity battery. 1. Can I convert it into a telephone line? A. Yes, by removing the relay or sounder that is in connection with each end of your main line, and substituting a telephone. 2. Must I use the battery to operate the telephone, or can I operate it without the use of a battery? A. The use of the battery is not necessary. 3. Can the ground be used the same as in the telegraph line? A. Yes. 4. Where will I find instructions for the construction of a magnet suitable for the telephonic instrument? A. See answer No. 16, p. 299, of SCIENTIFIC AMERICAN of November 10, 1877.

(20) J. P. writes: When I dip my pen in ink the silvered holder shows a spot of copper where it touches the ink. What is the cause? A. Galvanic action may be the cause. If so, copper is present in the ink.

(21) G. D. H. asks: Can the electrical arch be produced with a Grove's battery of 4 cups, and also can it be made by the current developed by a magneto-electric machine? A. Four cups of Grove's battery are hardly sufficient for this purpose. From 20 to 50 cups of Grove's or Bunsen's battery, or a magneto-electric machine, are generally used; see p. 1814 of the SUPPLEMENT of March 9, 1878.

Would two or three cubic inches of air, or as much as would remain in a gas bag holding three gallons, after the sides were brought together so as to expel as much air as possible, render the hydrogen with which the bag is to be filled dangerous to be ignited at the end of a tube a foot long? A. There is a possibility of the gas exploding under the circumstances you mention; if you first introduce into the collapsed bag a small quantity of gas, and then expel this, there will be less chance of an explosion; but a safer way is to interpose a wash bottle between the bag and the tube from which the gas is burnt.

(22) M. H. asks: 1. Can steel be mixed with melted cast iron when in the ladle? A. Yes. 2. If so, what per cent of steel can be used? A. There is scarcely any limit. 3. Does it improve the iron? A. So far as we know, in certain proportions and for special purposes, it does, but scarcely enough to make the mixture very desirable.

(23) H. S. R. asks: How should the cut-off valve on a slide valve engine be set to get the greatest amount of power, to cut off the steam at equal distances from each end of the cylinder, or at opposite points in the revolution of the crank? A. It is generally advisable to equalize the cut-off in reference to the stroke.

(24) L. G. writes: I have a boiler which is too small for its work, and intend putting in another in connection with it. The proposed new boiler is to be shorter and with less tubes than the present one. The connections are to be a steam pipe running from the top of the new boiler to the dome of the old one, and a water pipe at the back of the boilers. I propose to fire both boilers together, or with the same fireplace. Will this arrangement answer? A. Yes; if you fit check valves to the feed pipe, so that the water cannot be forced from one boiler into the other.

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(25) J. W. asks: 1. How is lead pipe prepared for making a wiped joint? A. Clean it thoroughly. 2. What is the solder composed of? A. Equal parts of lead and tin. 3. Are there any practical books on plumbing? A. Send for catalogue to one of the publishers who advertise in our columns.

(26) E. C. D. L. asks: How are concave razors made? A. By transverse grinding.

(27) H. L. asks: 1. How much heating surface is required for a yacht engine, 4 x 4 inches, to give plenty of steam without crowding the boiler? A. Make a boiler with about 100 square feet of heating surface. 2. Is a 3½ inch cylinder large enough for a boat 25 feet long and 5 feet beam? A. A cylinder 3½ x 5 inches will answer. 3. What is the best wheel for speed? A. A three-bladed screw, of as large diameter as can be immersed, will give good results.

(28) C. L. D. writes: 1. I have an upright tubular boiler 7 feet high, 26 inches diameter, 20 inches grate, 32 2-inch tubes 5 feet long. At what distance from the top of the boiler should I keep the water, with 60 lbs. pressure? A. From 12 to 15 inches. 2. Will it furnish any more steam with a given amount of coal than a boiler 2 feet shorter and tubes 3 feet long? A. Generally speaking, yes. 3. How much coal is generally used in 10 hours in such a boiler to produce 4 horse power? A. From 200 to 500 lbs. 4. What will be the best way to jacket a boiler—brick it to return the smoke down (after it has ascended the tubes) outside the boiler and in the chimney, or let the smoke go from the tubes to the chimney and brick it in? A. The first plan will generally be slightly more economical than the other. 5. My engine is 4 x 10 inches cylinder. If it is run 150 revolutions will it produce the same power that a cylinder 4 x 5 inches, run 300 revolutions, would? A. Other things being equal, it would. 6. Why are cylinders made lately 5 x 5, and 6 x 6, and 8 x 8, etc., and run so fast, instead of 5 x 10, etc.? A. To increase the efficiency for a given weight. 7. What distance should a 4 inch piston travel in a minute to produce a 4 horse power? A. It depends on the pressure.

(29) A. A. asks: Will Portland cement and sand make an artificial stone that will answer for a water table and window sills for a brick house? If so, what proportions are best? A. Coignet's béton (5 measures sand, 1 measure quicklime, ¼ to ⅛ measure hydraulic cement) will answer for the purpose about as well as stone.

(30) E. E. V. asks: What sized screw will it take to propel a flat bottomed boat 20 feet long, 6 feet beam, and 5 inches draught, at the rate of 3 miles an hour, with the screw two thirds immersed and running at the rate of 150 revolutions per minute? A. You have fixed the diameter by the draught and immersion. Make the pitch such as to give 1⅛ the required speed. A stern wheel will, however, probably answer better for such light draught.

(31) H. C. M. asks: What is the best way of removing lime scale in a locomotive boiler without injuring the latter, when the scale cannot be got at by mechanical means? A. Allow the water to become cool in the boiler before blowing out.

(32) W. O. asks how river steamers are propelled over bars. A. In some cases levers are used to lift the boats over, and in others they are pulled over by throwing out an anchor connected to a steam windlass.

(33) C. A. L. asks: What speed may be expected of a flat bottomed stern wheel boat 8 x 35 feet, drawing 1 foot of water, and having two slide valve (double valves) engines 4 x 12, with 150 lbs. steam? A. Probable speed, 5 to 6 miles an hour. 2. How many square feet of heating surface will be necessary to furnish steam enough with forced draught? A. Boiler may have from 150 to 200 square feet of heating surface. 3. If I set the boiler so that the fire can go all around it, will not that part of the shell above the water line become too hot and injured before steam is got up? A. By getting up steam slowly you will have no trouble. 4. Will I have to pay a license for running such a boat on the Missouri river? A. Yes.

(34) J. W. R. asks: 1. What is the horse power of a locomotive firebox boiler with 52 flues, each 7 feet long by 2¼ inches? A. There is no standard for rating the horse power of a boiler. 2. What is the horse power of a 10 x 22 inch engine? A. Multiply the area of the piston in square inches by the mean pressure in lbs. per square inch, and by the piston speed in feet per minute, and divide the product by 33,000. 3. How much coal per day of 10 hours would the boiler use? A. With a good draught such a boiler should burn from 12 to 15 lbs. of coal per square foot of grate per hour.

I wish to pump water 100 feet inclined up 45°. Can I do it with a common suction pump that carries 1 inch pipe by placing the pump half way and getting that far by suction and forcing the other part? A. You cannot draw water, in ordinary practice, through a vertical height much exceeding 27 feet.

(35) T. N. C. asks: Is there any well tested and established system of gas making by which half a million feet of heating or 200,000 feet of lighting gas can be made from a ton of pulverized coal by aid of steam? A. No. By Lowe's process about 43,000 cubic feet of combustible gas is obtained per ton of anthracite coal expended. This includes the fuel used under the steam generators.

(36) W. T. N asks: What is the mode of preparation of sodium sulphydrate, and how is it known commercially? A. The pure salt is prepared in the laboratory by passing hydric sulphide gas through an aqueous solution of pure sodium hydrate to saturation. Commercial sodium sulphide consists almost invariably of the higher sulphides, mixed with sulphite, hyposulphite, and sulphate of sodium.

(37) W. R. R. asks: How can I make indelible ink for marking clothing? A. India ink ground up with a little good writing fluid makes one of the best indelible inks known.

What will prevent plaster of Paris moulds used in vulcanizing from cracking in the dry heat? A. Dry the mould thoroughly in an oven and impose in an iron form.

(38) C. F. asks how rancid butter may be made palatable, or at least improved. A. Rancid butter if boiled in water with a tenth part of new animal charcoal will be divested of its rancidity, and may be used for cooking purposes, although its fresh flavor will not be restored. A better way is to melt the butter in a stoneware or enameled iron vessel over a water bath, with an equal quantity of fresh animal charcoal, in coarse powder free from dust, and strain through a clean piece of uncolored flannel. The butter may then be worked over with new milk, and colored, if desired, with a little annotto. Butter thus recovered will not remain sweet very long in warm weather, but this tendency towards rancidity is in a measure overcome by well salting it and adding a few grains of sodium salicylate to the pound while working it.

(39) L. H. F. asks: 1. What is the thickest solid armor plating put on vessels? A. About 18 inches. 2. How thick have such plates been rolled? A. 22 inches.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Corroded Cannon Primers. By W. P. M.
Fixation of Atmospheric Nitrogen. By J. J. B.
Steam Cannon. By H. S. B.
Locomotive Strokes. By F. G. W. and E. S. N.
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Stovepipe Joints. By W. R. A.
Dividing Circles into Odd Numbers of Parts. By T. S. M.
Velocipede Brakes. By I. H. D.
Extermination of Wild Beasts. By A. H. L.
Fast Locomotive Building. By D. Z. A.
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Smokeless Factory Chimneys. By J. C. E.
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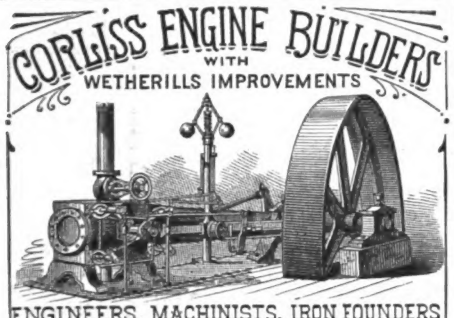

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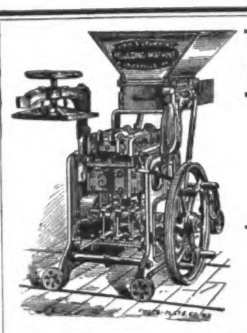

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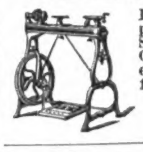

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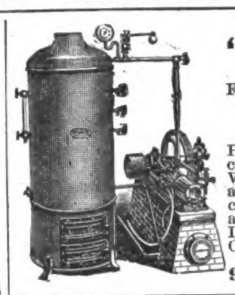

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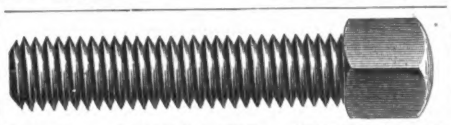

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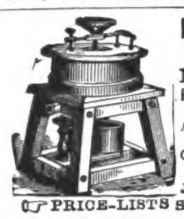

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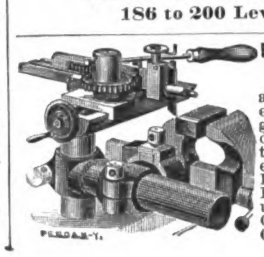

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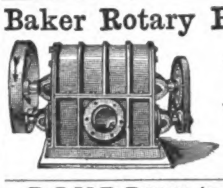

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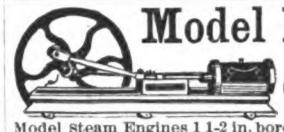

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